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IXODID TICKS (ACARINA, IXODIDAE) OF WEST  
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Zoology

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IXODID TICKS (ACARINA, IXODIDAE) OF WEST PAKISTAN

by  
Vincent Cormac Mc Carthy

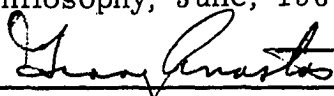
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of the requirements for the degree of  
Doctor of Philosophy  
1967

## APPROVAL SHEET

Title of Thesis: Ixodid Ticks (Acarina, Ixodidae) of West Pakistan

Name of Candidate: Vincent C. McCarthy  
Doctor of Philosophy, June, 1967

Thesis and Abstract Approved:



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Date Approved:



## PREFACE

As of this writing Pakistan and India share an uneasy truce along their common borders. Since 1962, when our tick collections started, these borders have shifted back and forth according to the fortunes of war. It is not the purpose of this work to attempt to demarcate these boundaries or to comment upon the disposition of those regions now in dispute — rather, we have collected specimens where we could find them, hoping that the information expressed here may someday prove of value to the people of those regions, whatever their national destiny.

This project could not have been carried out without the assistance of many groups and individuals. In particular I would like to express my gratitude to Dr. George Anastos, Professor and Head of the Department of Zoology, University of Maryland, for his critical comments as an expert in acarology, and especially for his wise and friendly counsel on problems encountered in the course of this work. To Dr. Herbert Barnett, Director of Pakistan Medical Research Center, I am indebted for the opportunity to collect in West Pakistan and for his continuing support during the time this work was in preparation. I am also most grateful for the assistance given me by the staff of Pakistan Medical Research Center and the Institute of International Medicine, University of Maryland School of Medicine. Especial thanks go to my assistants in Pakistan: Mr. Zahid Beg Mirza, Curator of the Museum of Natural

History of Panjab University (formerly of Pakistan Medical Research Center), for his help in collecting these specimens and for his expert identification of the animal host fauna, and Mr. Nazeer M. Khan for his numerous collections. Through the kindness of Dr. Robert Traub of the Department of Microbiology, University of Maryland School of Medicine, I was allowed to examine collections made by members of that department from mammals during 1963 - 1965. These collections yielded several species not previously reported from West Pakistan.

Logistical support of this project in Pakistan was greatly assisted by the United States Agency for International Development. Additional assistance was given by the Government of Pakistan; especially the Bureau of Animal Husbandry which contributed several important tick collections, the Department of Wildlife and Fisheries which assisted in wild animal collections, and the Indus Rangers, whose help in border regions was invaluable. Both the late Dr. M. M. Sarwar, Director of the Biological Products Section of the Bureau of Animal Husbandry, and Capt. Mahmood Ahmad, Director of Animal Husbandry in Azad Kashmir, contributed several valuable collections to our study.

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My greatest debt is to the people of Pakistan; headmen, herdsmen, tribal leaders, farmers. Wherever my field trips led me, I was met with unfailing kindness, courtesy and assistance. To the citizens of Pakistan I can only say "Shukria".

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## INTRODUCTION

Seek simplicity,  
and distrust it.

— Alfred North Whitehead

The Province of West Pakistan came into being in 1947, under the provisions of the Indian Independence Act. Today the province consists of an area of 310,403 square miles, occupied by approximately 50 million people. West Pakistan is divided into 12 administrative divisions: Bahawalpur, Dera Ismail Khan, Hyderabad, Kalat, Karachi, Khairpur, Lahore, Multan, Peshawar, Quetta, Rawalpindi and Sargodha.

Ahmad (1964) divided West Pakistan into six major physical regions:

1. The Northern Mountains
  2. The Western Bordering Mountains
  3. The Salt Range and the Potwar Plateau
  4. The Upper Indus Plain
  5. The Lower Indus Plain
  6. The Baluchistan Plateau
1. The Northern Mountains

The western Himalayas extend through Kashmir into the northern part of Peshawar Division. These mountains commence as low, rolling hills, about 3,000 ft. high, and reach their highest point in northern Kashmir where Godwin Austin (K2) rises to 28,250 feet. The mountains

serve as a barrier to the winds and climate of Central Asia; the more southern mountains intercept the winds of the Arabian Sea and the Bay of Bengal. Thus these mountains receive more than double the average rainfall of West Pakistan as a whole (e.g., Murree, a hill station, averages 59.4 in. of rain per year). The higher peaks are permanently covered with snow. In spring and summer a part of this cover melts and feeds the river systems of West Pakistan.

In fertile valleys (e.g., Swat) the climate is temperate in the lower regions. In higher regions the climate is cooler and agriculture gives way to timberland. In less fertile regions (e.g., the Kagan Valley) agriculture is limited, sagebrush predominates in the lower regions and the timber growth is reduced. In both areas the climate above 10,000 ft. is alpine-arctic.

## 2. The Western Bordering Mountains

These outliers of the Himalayas extend to the southwest from the western part of Peshawar Division through the northern part of Quetta Division. Offshoots of these ranges extend southward (e.g., the Sulaiman and Kirthar Ranges) and serve to demarcate the eastern limits of the Baluchistan Plateau. These mountains, averaging 7,000 – 12,000 ft., are lower than the northern mountains and outside the path of the monsoon winds. As a result, they and the valleys between them are dry and barren. The climate ranges from hot and dry in summer to cold and dry in winter; vegetation is minimal.

### 3. The Salt Range and Potwar Plateau

The Salt Range separates the Potwar Plateau from the Punjab Plains. It commences near Jhelum in Rawalpindi Division and extends through the northern part of Sargodha Division into the eastern part of Dera Ismail Khan Division. Jagged spurs and crests rise to 5,000 ft., but the average height of the range is about 2,200 ft. Large deposits of rock salts and minerals are found in these regions. In the north, occasional trees survive, but for the most part the land is arid and bleak. Vegetation is sparse and stunted.

To the north of the Salt Range, the Potwar Plateau covers an area of over 4,000 square miles. The altitude varies from 1,000 to 2,000 ft., and the region consists mainly of eroded sandstone ravines, weathered by the seasonal rains which have washed away the topsoil. Grain farming is attempted, but with little success. Profitable farming is limited to a region northeast of Attock, near the Indus River. In this region the annual rainfall ranges from 15 to 25 inches, elsewhere it is less. The temperature ranges are extreme, from freezing in winter to 120° F. in summer. This area comprises much of Rawalpindi Division and part of Peshawar Division.

### 4. The Upper Indus Plain

Much of this region was formerly known as West Punjab. It consists of a broad, fertile, alluvial plain extending from Jhelum in the north to the confluence of the major rivers of the Indus basin (the Indus, the Sutlej, the Beas, the Ravi, the Chenab and the Jhelum) in the south.



The area in general is highly productive, due in part to an extensive irrigation system. Elevations in the northeastern part of the plain range from 600 to 1,000 ft. Elevation decreases at the rate of one foot per mile as the plain stretches southward to the edge of the Thar Desert in Bahawalpur Division. Rainfall averages 10 to 20 inches through much of the region, but two crops are raised annually with the aid of tube-well and canal irrigation. Most of the rain is deposited during the July – September monsoon. The day temperature in winter is near 60°F, but the night temperature approaches freezing. Summers are hot and dry until the arrival of the monsoon, which decreases the day temperature to 105°<sup>+</sup>F., but raises the humidity to the saturation level. Two desert regions exist in this general area. The Thal Desert extends west of the Jhelum River from Sargodha Division up into Rawalpindi Division. The Thar Desert extends from the northwest of India and covers much of Bahawalpur Division. The Upper Indus Plain encompasses the Divisions of Lahore, Sargodha and Multan; it touches upon the Divisions of Rawalpindi, Peshawar, D. I. Khan and Bahawalpur.

#### 5. The Lower Indus Plain

Below Mithankot in Sind, the Indus, augmented by its tributaries, flows southward to the Arabian Sea. The river flows slowly, bringing with it the soil from the northern regions. The settling of this soil in the river bed gradually raises the level of the river above that of the plain with a consequent shifting of the river. In recent times, embankments have halted this shift and canal irrigation has opened much of the border-

ing wasteland to cultivation. To the east of the Indus, where the cultivation ends, the Thar Desert begins. The region in general is hot and arid, averaging less than five inches of rainfall per year. The delta of the Indus is sea influenced, more temperate and humid. In this area the brackish nature of the soil and the annual incursions of the Arabian Sea have caused the region to remain an uncultivated marshland. To the west of the Indus, the northern regions are irrigated and similar to those east of the Indus. In midregion the Kirthar Range extends almost to the bank of the Indus. To the south the hills pull back from the river, leaving a barren plain that extends to the Arabian Sea. The Lower Indus Plain is divided into the Divisions of Karachi, Hyderabad and Khairpur.

#### 6. The Baluchistan Plateau

To the west of the Indus Basin, the Kirthar and Sulaiman mountains mark the start of the Baluchistan Plateau. This plateau extends from the Gomul River in the northeast into the Iranian Plateau in the west. The northern boundaries of this region are the Toba Kakar and Changai Ranges, the southern boundary is the coastal Makran Range which borders on the Arabian Sea. In the east the mountains range up to 11,000 ft.; gradually the mountains decline to elevations of 4,000 — 7,000 ft. in the middle regions and the average elevation for most of the plateau is 1,000 ft. Exceptions to this are the Quetta node (5,000 — 11,000 ft.) and the Kalat Plateau (7,000 — 8,000 ft.). The northwestern part of the plateau is mainly desert; most of the remaining area consists of a series of eroded ravines and low lying hills, running from northeast to southwest.

Annual rainfall in this area ranges from 0 to 10 inches and is completely unpredictable. Temperatures vary greatly (changes of over 80°F. in 24 hours have been reported), and constant, prevailing, northwest winds blow hot and dry in the summer and cold and dry in the winter. Both population and vegetation are scanty. The population is mainly nomadic, but some agriculture is attempted through the use of karez. This area comprises the divisions of Quetta and Kalat.

### Historical Review Of The Literature

Literature concerning the scutate ticks of West Pakistan (per se) is virtually nonexistent. Earlier workers considered the "Indian subcontinent" as a whole, and today many writers continue to do so. This unfortunate lumping of widely diverse regions has resulted in an acute paucity of knowledge about the region that constitutes West Pakistan, a fact which is commonly overlooked since much has been written about the peninsular regions of the subcontinent. In most cases, it is necessary to apply both induction and deduction to the tick literature of those countries adjoining West Pakistan.

While ticks have been reported from pre-partition India since the time of Linnaeus, the first comprehensive series to cover this region was that of Nuttall, Warburton, Robinson and Cooper (1908 - 1926). In 1928 Sharif published his "Revision of the Indian Ixodidae. . ." . This important work represented the first comprehensive survey of the subcontinent. Later Sen (1938), following the classifications of Sharif, extended the

range of several species. However, in both these works, the tick fauna of northwest India was not well represented. Since then, the only major taxonomic work to include West Pakistan was Kaiser and Hoogstraal's (1964) revision of the Hyalomma.

In recent years, several important works have been published on the ticks of Afghanistan. Anastos (1954, 1956) reported the presence of several species previously unknown in this region; Kaiser and Hoogstraal (1963) described several species of Hyalomma which later were found in western West Pakistan.

In Iran, Abbassian-Lintzen (1960) listed the distribution of several pertinent species. Her 1961 paper on the ticks of southeast Iran was invaluable as all the species reported by her are also present in West Pakistan.

While the Soviet Union does not border on West Pakistan, a large number of species are common to both countries. The 1950 English translation of Pomerantsev's Fauna of the U.S.S.R., Arachnida is most useful. Anastos (1957) has provided an excellent literature review of Soviet literature, but unfortunately translations of most of the papers listed are not available.

Numerous taxonomic papers have been published on the individual species covered in this work. These are referred to, where pertinent, in the body of the text.

If little is known about tick taxonomy in West Pakistan, still less is known about tick transmission of disease agents. Summaries of this

subject have been written by Sharif (1938) and Abdussalam (1959), but the great bulk of this material refers to regions outside West Pakistan. This is a subject sorely in need of investigation.

### Materials and Methods

Specimens were collected from both domestic and wild hosts. While domestic stock was relatively easy to examine, several methods were employed to collect wild hosts. Many species were collected by traditional hunting methods with rifle and shotgun. Nocturnal hunting was abetted by jacklighting and jeeps were employed for chase wherever terrain permitted. Small mammals were trapped with locally made wire box traps. Commercial metal box traps and spring snap traps were less effective. Trapped animals were chloroformed, placed in plastic bags, and allowed to rot for 24 hours. Then both carcass and bag were examined for ectoparasites. Mist net trapping of birds was attempted with only slight success. This method requires tall background foliage for net concealment, and where these conditions were present, so also were many wandering sheep, goats, cattle, small boys, etc., etc. Additional material was collected by flagging with cotton cloth through low brush regions and by filtering the debris of animal burrows and birds' nests through fine wire mesh.

The collected tick specimens were given field numbers and stored in vials containing a 70 per cent ethanol solution. Host animals were also given a field number, measured and skinned; the skulls and skins

were then preserved for later study.

The ticks were examined and identified using a Leitz binocular dissecting scope. Measurements and drawings were made with the aid of a calibrated ocular micrometer.

Most of the tick specimens collected by the staff of Pakistan Medical Research Center during 1962-1964 have been deposited in the tick collection of the Department of Zoology of the University of Maryland. The remaining material (mainly immature stages) has been deposited in the tick collection of Dr. Harry Hoogstraal, NAMRU-3, Cairo.

Geographical references in this work are taken from Ahmad (1964) and Spate (1957). Maps used were: A Road Map of West Pakistan, Second Edition, 1958, Government of Pakistan, and 50 Mile Map of Pakistan, Fourth Edition, 1962, Government of Pakistan. Nomenclature for host species may be found in Ripley (1961) and Walker (1964).

### Terminology

The terminology used herein (with modifications) is that of Elbl and Anastos (1964).

Accessory anal shields: Small, sclerotized projections or shields exterior to the adanal shields in males of Hyalomma, Rhipicephalus and Boophilus.

Adanal shields: Paired ventral shields surrounding the anus in males of Hyalomma, Rhipicephalus and Boophilus.

Anal groove: A groove that encloses fully or partially the anus.

Anus: The posterior opening of the alimentary tract. It consists of two movable valves surrounded by a chitinized ring, and is situated caudally and ventrally on the medial line.

Article: A definite and distinct division of a jointed appendage. Restricted in this work to the four divisions of the palpi.

Auriculae: Paired ventral projections at the sides of the basis capituli in some species of Ixodes.

Basis capituli: The basal portion of the capitulum to which the mouth parts are attached.

Capitulum: The anterior portion of the tick including the basis capituli, palpi, hypostome and chelicerae.

Cervical grooves: Paired anterior depressions on the scuta of both sexes.

Chelicerae: Paired mouthparts located dorsally on the hyposome, each terminating in an internal and an external, serrated digit.

Cornua: Caudal projections extending from the latero-posterodorsal margin of the basis capituli.

Corona: The apical portion of the hypostome, usually armed with many small denticles.

Coxae: The paired ventral plates to which the legs are movably attached. Beginning anteriorly, they are designated as I, II, III, and IV.

Denticles: The individual, recurved teeth on the ventral side of the hypostome, usually arranged in parallel longitudinal rows or files.

Dentition: The arrangement or number of files of denticles on either side of the median line of the hypstome.

Dorsal ridge: The posterior, transverse ridge between the cornua.

Festoons: Uniform, more or less rectangular areas separated by grooves, along the posterior submarginal area of the dorsum of both sexes of

all the genera but Boophilus and Ixodes.

Genital aperture: The sexual opening of adult ticks situated medially between the coxae.

Genital apron (= operculum): The small sclerotized plate covering the genital aperture in some of the species.

Genital grooves: Long, ventral grooves diverging from each side of the genital aperture and extending close to the posterior margin of the body.

Goblets: The numerous pores surrounding the macula in the spiracular plate.

Hypostome: The median ventral member of the piercing mouthparts bearing rows or files of denticles.

Lateral grooves: The dorsal grooves at the sides of the scutum in male ixodid ticks.

Macula: The heavy sclerotized central portion of the spiracular plate.

Marginal grooves: The dorsal grooves posterior to the scutum at the sides of the body in the female.

Ornamentation: The pattern of enameling or the pattern produced by the enameling in Aponomma or Dermacentor.

Palpi: The movable, paired appendages, parallel on each side of the hypostome. Each consists of four articles numbered from the base. The first article may be reduced or absent.

Paramedian grooves: A pair of short, shallow grooves paralleling the posteromedian groove.



Parma: The median festoon, when differentiated or differing in color from the other festoons.

Porose areas: The paired, roundish, usually depressed areas with pitted or irregular bases located on the dorsoposterior portion of the female basis capituli.

Posteromedian groove: The shallow groove on the scutum of the male of some species, usually extending medially from midscutum to posterior margin.

Preanal groove: The anterior extension of the anal groove which surrounds the anus. Characteristic of the genus Ixodes.

Punctations: Pits in the surface of the scutum and other parts of the exoskeleton; these vary in size, depth, density and pattern of distribution.

Scapulae: The anterior angles of the scutum in both sexes.

Scutum: The sclerotized plate covering all or most of the dorsum in males and the anterior portion of the dorsum in females.

Setae: Minute hairs found on all species, especially in capitular regions.

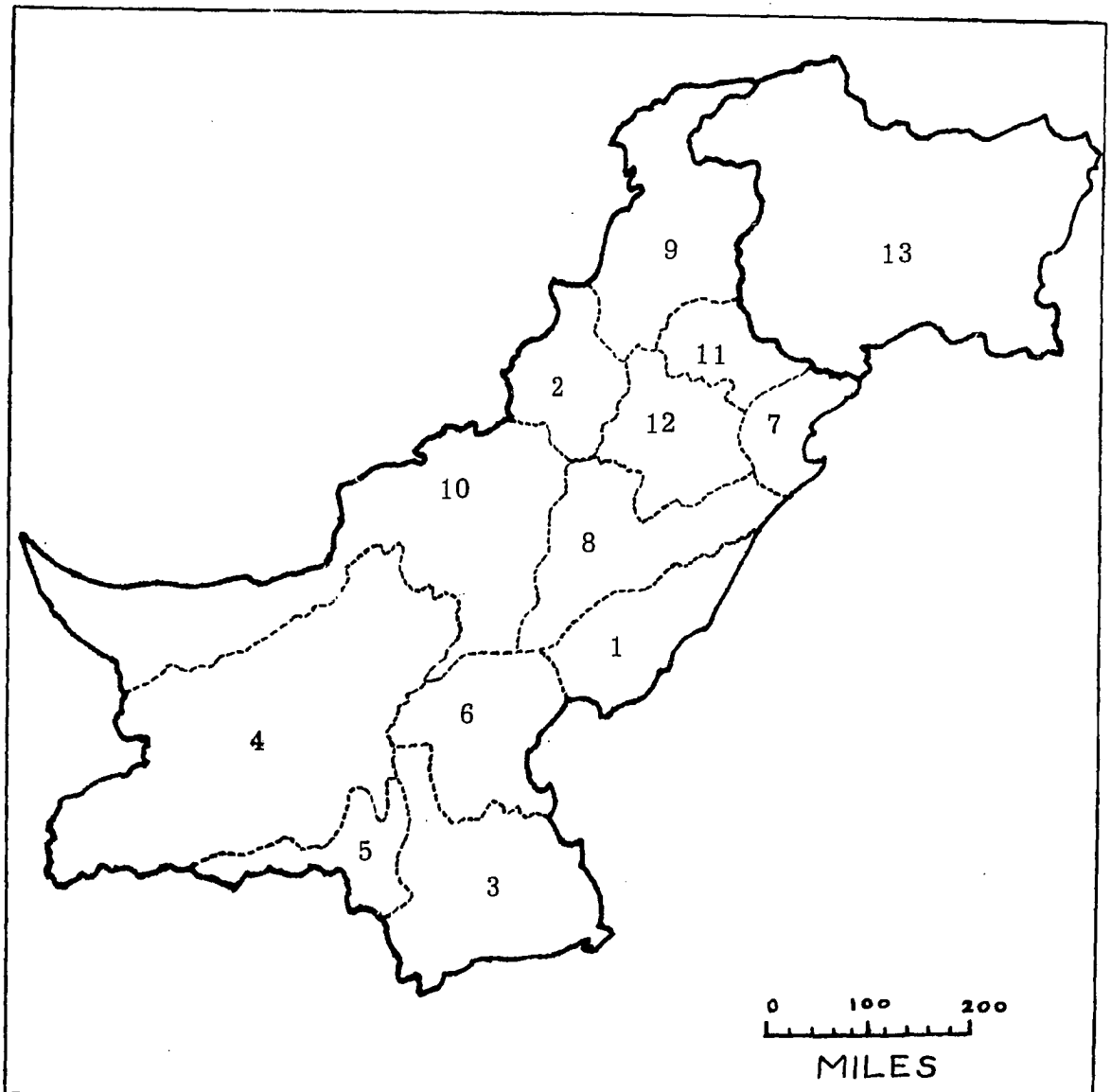
Spiracular plates: The paired, respiratory pores, usually situated behind and lateral to coxae IV.

Subanal shields: The small paired shields posterior to the adanal shields in the males of most species of Hyalomma.

Tarsal hump: The terminal dorsal hump, present on the tarsi of certain species.

Tarsus: The terminal segment of the leg.

Trochanter: The second segment of the leg; attaches to the coxa.

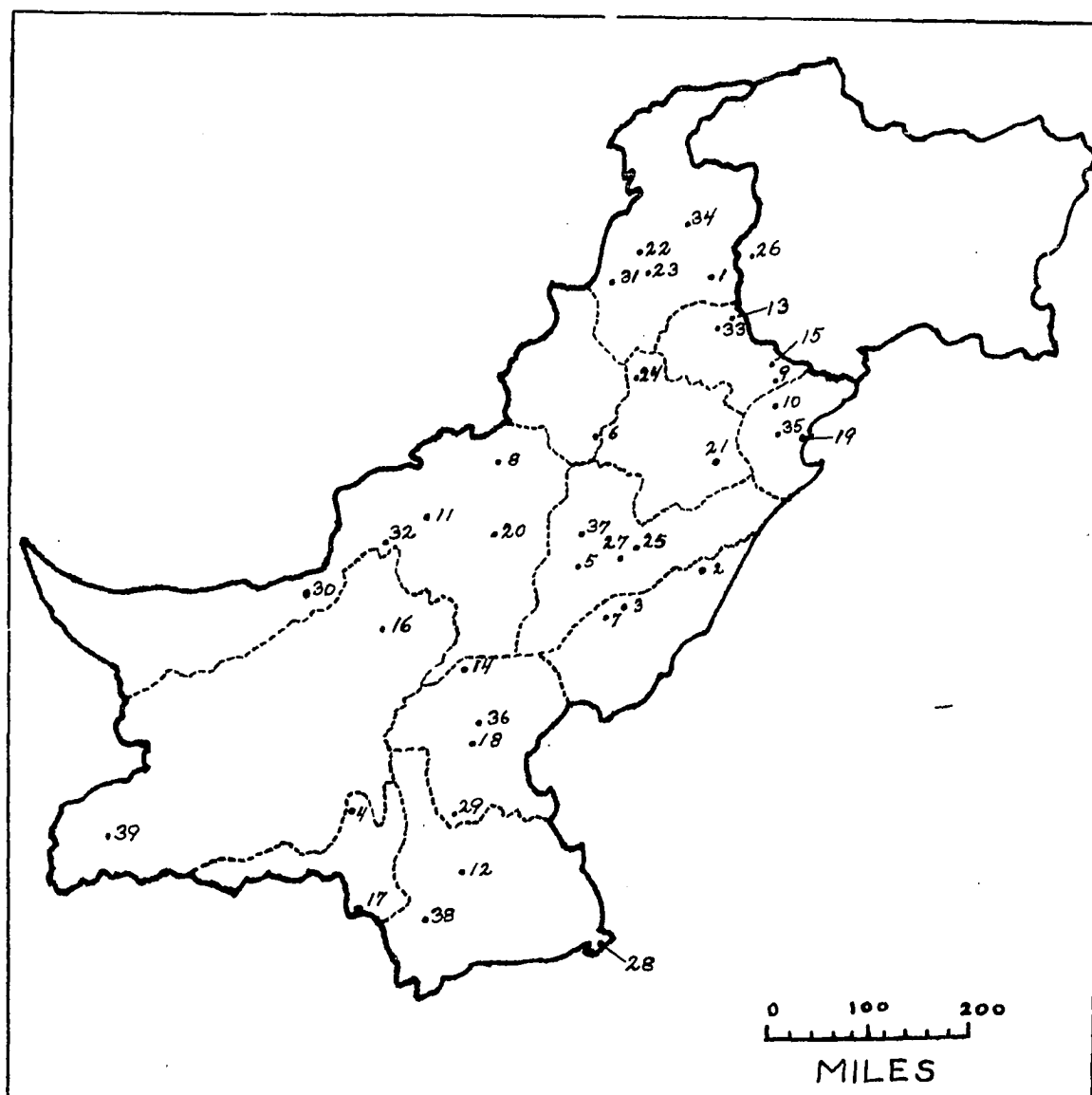


Map I. The twelve Administrative Divisions of West Pakistan.

- |                     |                |
|---------------------|----------------|
| 1. Bahawalpur       | 7. Lahore      |
| 2. Dera Ismail Khan | 8. Multan      |
| 3. Hyderabad        | 9. Peshawar    |
| 4. Kalat            | 10. Quetta     |
| 5. Karachi          | 11. Rawalpindi |
| 6. Khairpur         | 12. Sargodha   |

Disputed Territory

13. Jammu and Kashmir



Map II. Major cities and towns of West Pakistan.

- |                     |                  |                  |
|---------------------|------------------|------------------|
| 1. Abbottabad       | 14. Jacobabad    | 27. Muzaffargarh |
| 2. Bahawalnagar     | 15. Jhelum       | 28. Nagar Parkar |
| 3. Bahawalpur       | 16. Kalat        | 29. Nawabshah    |
| 4. Bela             | 17. Karachi      | 30. Nushki       |
| 5. Dera Ghazi Khan  | 18. Khairpur     | 31. Peshawar     |
| 6. Dera Ismail Khan | 19. Lahore       | 32. Quetta       |
| 7. Dera Nawab Sahib | 20. Loralai      | 33. Rawalpindi   |
| 8. Fort Sandeman    | 21. Lyallpur     | 34. Saidu Sharif |
| 9. Gujrat           | 22. Malakand     | 35. Sheikhpura   |
| 10. Gujranwala      | 23. Mardan       | 36. Sukkur       |
| 11. Hindubagh       | 24. Mianwali     | 37. Taunsa       |
| 12. Hyderabad       | 25. Multan       | 38. Tatta        |
| 13. Islamabad       | 26. Muzaffarabad | 39. Turbat       |

## ORDER ACARINA

### Superfamily Ixodoidea

### FAMILY IXODIDAE Murray, 1877

Eight genera in this family have been collected in West Pakistan.

#### Key to the Genera

##### Males

1. Preanal groove present ..... Ixodes  
Preanal groove absent ..... 2
2. Adanal shields present ..... 6  
Adanal shields absent ..... 3
3. Eyes present (sometimes indistinct) ..... 4  
Eyes absent ..... 5
4. Scutum inornate; palps long and slender; coxa IV  
normal ..... Amblyomma  
Scutum ornate; palps short and broad; coxa IV  
elongate ..... Dermacentor
5. Scutum usually ornate; palps long and slender;  
medium sized ticks ..... Aponomma  
Scutum inornate; palps short and broad; small  
ticks ..... Haemaphysalis

6. Palps long; eyes circular and socketed ..... Hyalomma  
 Palps short to medium sized; eyes elongate, not  
 socketed, on margin of scutum ..... 7
7. Palps very short; without festoons; postanal groove  
 indistinct..... Boophilus  
 Palps short to medium sized; with festoons; postanal  
 groove distinct ..... Rhipicephalus

### Females

1. Preanal groove present ..... Ixodes  
 Preanal groove absent ..... 2
2. Eyes absent ..... 3  
 Eyes present ..... 4
3. Palps short and broad, article 2 angulated laterally;  
 scutum inornate ..... Haemaphysalis  
 Palps long and narrow, article 2 not angulated laterally;  
 scutum usually ornate ..... Aponomma
4. Palps short to medium sized ..... 5  
 Palps long and narrow ..... 7
5. Scutum ornate ..... Dermacentor  
 Scutum inornate ..... 6
6. Palps short; spurs of coxa I reduced or absent  
 (especially the inner spur) ..... Boophilus

Palps medium sized; 2 spurs of coxa I

prominent ..... Rhipicephalus

7. Eyes circular and socketed; palpal article 2 less

than twice as long as article 3 ..... Hyalomma

Eyes elongate, not socketed, on margin of scutum;

article 2 at least twice as long as article 3 ..... Amblyomma

GENUS AMBLYOMMA KOCH, 1844

Introduction

Of the nearly one hundred known species of Amblyomma only eight are found on the Indo-Pakistan subcontinent, and only one species has been collected in West Pakistan.

AMBLYOMMA JAVANENSE (SUPINO, 1897)

Synonymy

Rhipicephalus javanensis

Supino, 1897, Atti Soc. Veneto-Trent Sci. Nat., series 2, 3 (1): 233 (Karkecet [Tenasserim] off Manis javanica; type in Genoa Mus.).

Amblyomma sublaeve

Neumann, 1899, Mém. Soc. Zool. France, 12: 204, 221 (2♀, Siam; cotypes in Paris Mus.).

Warburton, 1910, Parasitology, 3: 396 (many localities in India).

Robinson, 1926, Ticks, 2 (4): 17, 23, 244-247.

Sharif, 1928, Rec. Indian Mus., 30 (3): 328-330 (♀, Punjab off Vesperugo abramus).

Sen, 1938, Indian Jour. Vet. Sci. and Animal Husbandry, 8: 133-147.



Amblyomma javanense

Schulze, 1934, Zeitschr. Parasitenk., 7 (2): 167.

Anastos, 1950, Ent. Amer., 30 (1-4): 102-106.

### Hosts, Distribution and Biology

Amblyomma javanense is a one host tick in West Pakistan. All stages were found in 11 collections off Manis crassicaudata. Other collectors have recorded it from various species of Manis, Vesperugo abramus, Python molurus, Geoemyda tricarinata, Hyaena hyaena, bear, Sambar deer and wild pig.

Sharif (1928) recorded this species (as Amblyomma sublaeve) from Rajanpur in Multan Division and from Karachi Division. The 11 aforementioned collections came from the Jhelum District of the Rawalpindi Division during the months of January—May.

This species is common throughout the Orient, and has been reported from East Pakistan, India, Burma, China, Ceylon, Malaysia, Indonesia, Thailand and the Philippines.

The biology of this tick is unknown.

### Disease Relationship

A. javanense is not known to attack either man or domestic animals. Its vector potential has not been assessed.

## Description - Male (Fig. 1, A-G )

1. Body. Medium sized, yellowish brown. Sixteen specimens, length 4.6 mm - 5.8 mm, average 5.4 mm; width 3.0 mm - 3.8 mm, average 3.5 mm.

2. Scutum. Inornate; yellowish brown, dark reddish brown in peripheral regions. Length 3.7 mm - 4.9 mm, average 4.3 mm; width, same as body width, widest in posterior third of scutum. Punctations sparse, mainly on posterior half. Cervical grooves small, distinct and inverted comma-shaped. Lateral grooves faint, highly punctate, extending into the anterior third of the scutum. Fестоons prominent. Eyes small, indistinct.

3. Venter. Wrinkled, with small punctations. Genital aperture between coxae II. Anal aperture even with posterior borders of spiracular plates. Spiracular plates large, long and comma-shaped.

4. Legs. Strong, moderate length. Coxa I with two broad, well separated spurs; coxae II - IV with a single broad comb spur. Tarsi humped.

5. Capitulum. Longer than wide. Length 1.0 mm - 1.5 mm, average 1.2 mm; width 0.6 mm - 0.8 mm, average 0.7 mm. Basis capituli subtriangular, widest at posterior margin, margin straight, cornua minute. Palps long, especially article 2.

6. Hypostome. Long, average length 0.7 mm. Dentition 3/3, teeth strong. Corona small, tip notched.

## Description - Female (Fig. 1, H-N )

1. Body. Six specimens, length 6.0 mm (partially engorged) - 8.1 mm (engorged); width 3.9 mm (partially engorged) - 5.1 mm (engorged).
2. Scutum. Inornate, dark brown, cordiform. Length 2.0 mm - 2.5 mm, average 2.2 mm; width 2.2 mm - 2.6 mm, average 2.4 mm. Scapulae large. Cervical grooves short, inverted comma-shaped. Numerous shallow punctations distributed on anterior two-thirds of scutum. Eyes small and indistinct.
3. Venter. Yellowish brown with many small punctations and setae on posterior two-thirds. Festoons prominent. Genital aperture at level of posterior margin of coxa II. Anal aperture below level of posterior margins of spiracular plates. Spiracular plates broadly comma-shaped, much broader than those of male.
4. Legs. More slender than those of male. Coxae and tarsi similar to those of male.
5. Capitulum. Longer than wide. Length 1.3 mm - 1.4 mm; width 0.8 mm - 0.9 mm. Basis capituli subtriangular, posterior margin slightly concave, cornua absent; porose areas deep, ovoid and distinct. Palps long, widening anteriorly.
6. Hypostome. Long, average length 0.9 mm, notched apically. Dentition 3/3, teeth strong.

## Remarks

Santos Dias (1958) has placed A. javanense in synonymy with

Amblyomma fuscilineatum Lucas, 1847. This however, is a debatable point for while Lucas describes several characters typical of A. javanense he fails to mention others which are vital to the taxonomy of this genus. In the absence of the Lucas specimens, and in order to prevent further confusion in a species whose history abounds with spurious names, the designation A. javanense is retained.

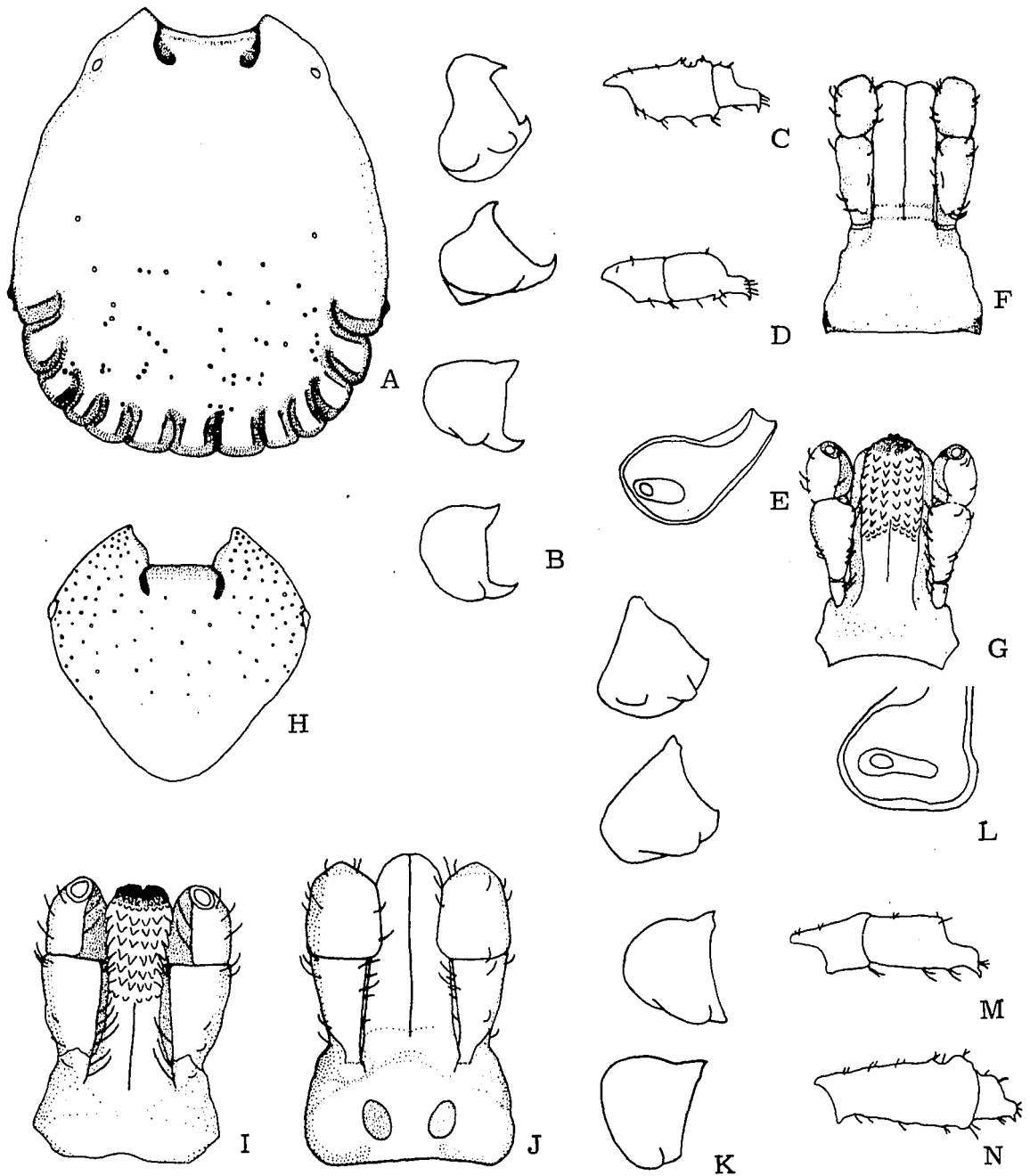
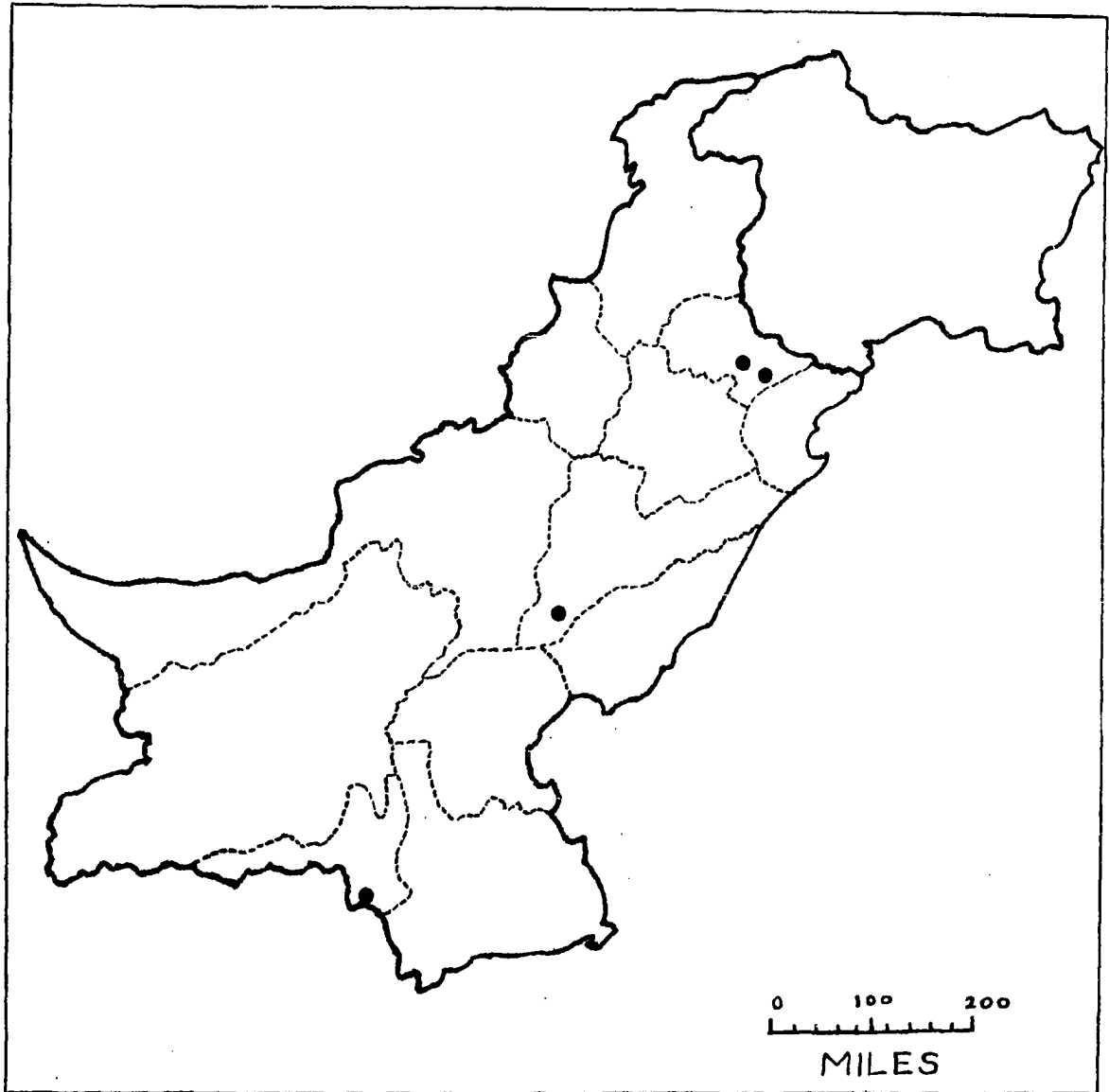


Fig. 1. *Amblyomma javanense* (Supino, 1897). A-G, male: A-scutum; B-coxae I to IV; C-tarsus I; D-tarsus IV; E-spiracular plate; F-capitulum, dorsal view; G-capitulum, ventral view. H-N, female: H-scutum; I-capitulum, dorsal view; J-capitulum, ventral view; K-coxae I-IV; L-spiracular plate; M-tarsus I; N-tarsus IV.



Map III. Amblyomma javanense (Supino, 1897).  
Geographical distribution — West Pakistan

## GENUS APONOMMA NEUMANN, 1899

### Introduction

Only one species in this genus has been reported from the areas which now constitute West Pakistan.

### APONOMMA GERVAISII (LUCAS, 1847)

### Synonymy

#### Ixodes gervaisii

Lucas, 1847, Ann. Soc. Ent. France, 5: 99, 100.

#### Aponomma gervaisi

Neumann, 1899, Mém. Soc. Zool. France, 12: 182-185.

Warburton, 1910, Parasitology, 3 (4): 405, 406.

Sharif, 1928, Rec. Indian Mus., 30 (3): 334-337.

Sen, 1938, Indian Jour. Vet. Sci. and Animal Husbandry, 8: 133-147.

### Hosts, Distribution and Biology

All stages of Aponomma gervaisii have been collected off Varanus monitor in West Pakistan. Other hosts listed by Sharif (1928) are: Varanus nebulosus, Varanus bengalensis, Naja tripudians and Zamenis mucosus. Sharif also lists a wide distribution for this species but

Schulze (1935a) and Anastos (1950) both restrict it to India and Ceylon.

In West Pakistan A. gervaisii has been collected from the areas around Lahore, Karachi and Kabirwala in Multan Division.

Adults have been collected during the months of February, May, July and November.

#### Disease Relationship

A. gervaisii is not known to attack either man or domestic animals. Its vector potential has not been assessed.

#### Description - Male (Fig. 2, A-G )

1. Body. Small. Six specimens, length 2.8 mm - 3.2 mm, average 2.9 mm; width 2.1 mm - 2.3 mm, average 2.2 mm.

2. Scutum. Subcircular, wider than long. Length 2.0 mm - 2.3 mm, average 2.1 mm; width same as body width. Scutum highly ornamented, seven metallic yellowish green blotches overlies the basic brown color. The blotches are distributed as follows: One pair lies between the cervical grooves and the lateral margins. These are sometimes faint, or coalesced with the following pair which lie near the lateral border slightly below the level of the posterior end of the cervical grooves, and proceed to the level of the second festoons. These in turn are sometimes fused with the third pair which lie near the posterior margin of the scutum. Occasional specimens show a coalescence of all the above mentioned blotches into a single band which



encircles over three quarters of the scutum. An additional large blotch lies on the median part of the scutum.

Cervical grooves short, deep, inverted comma-shape. Lateral grooves absent. Festoons prominent. Punctations large, deep, distributed over entire scutum.

3. Venter. Pale greenish yellow, moderately punctate. Genital aperture between coxae II. Spiracular plates comma-shaped; dorsal margins irregular and curved.

4. Legs. Moderate. Coxae I - IV with single, pointed spurs (see "Remarks" for a discussion of coxa I). Tarsi I - IV humped.

5. Capitulum. Average length 0.9 mm; average width 0.5 mm. Basis capituli subpentagonal. Cornua obsolete. Palps long, thin. Article 2 more than one and a half times longer than article 3.

6. Hypostome. Long, rounded, average length 0.6 mm. Dentition 3/3, teeth moderate but few in number.

#### Description - Female (Fig. 2, H-N )

1. Body. Pale olive green to dark brown. Five specimens, length 3.4 mm (unengorged) - 7.3 mm (engorged); width 2.4 mm (unengorged) - 5.3 mm (engorged).

2. Scutum. Brown, cordiform. Length 1.5 mm - 1.7 mm, average 1.6 mm; width 1.7 mm - 1.9 mm, average 1.8 mm. Cervical grooves short, inverted comma-shaped. Three metallic-green blotches cover more than half the scutum. Twin blotches extend from the scap-

ular regions, down the lateral border to the posterior half of the scutum. The third blotch is elongate and pear-shaped. It lies on the midline of the scutum and extends from the posterior margin of the scutum to a point just below the posterior border of the cervical grooves.

3. Venter. Tan to pale brown. Genital aperture on a level between coxae II and coxae III. Spiracular plates broadly comma-shaped.

4. Legs. As in the male. Coxae II - IV as in the male; coxa I with spur slightly indented, appearing weakly bifid in some specimens but only faintly discernible in others.

5. Capitulum. As in the male. Average length 0.9 mm; average width 0.6 mm. Porose depressions of basis capituli deep, distinct and circular.

6. Hypostome. As in the male. Average length 0.5 mm. Dentition 3/3, teeth moderate.

#### Remarks

Previous records have limited the hosts of A. gervaisii to various members of Class Reptilia; however, one collection off a cotton teal (Nettapus coromandeliannus), 40 miles SW of Lahore, yielded ten nymphs of Aponomma which cannot be distinguished from nymphs of A. gervaisii collected from Varanus monitor in the same area.

This species closely resembles Aponomma lucasi and was for many years confused with it. Warburton (1910) first separated the two

species as varieties. Later Schulze (1932) pointed out that these might be distinct species and referred to them as such in subsequent publications. The raising of lucasi to the specific level renders suspect the earlier geographical distribution records for A. gervaisii. Schulze (1935a) is supported by Anastos (1950) in his limiting the range of A. gervaisii to the Indo-Pakistan subcontinent and Ceylon.

Santos Dias (1958) has declared A. gervaisii to be a synonym of Aponomma ophiophilum (Müller, 1831). He bases his opinion on the fact that Müller's drawings show the scutum with large scapular spots and coxa I with a single spur. Warburton describes coxa I as faintly bidentate. Examination of Pakistani material shows both forms, with many specimens intermediate. Santos Dias states that Müller's description is "poor", and that the host (Dipsas sp.) is of unknown origin.

While it is possible that Santos Dias is correct, it would serve little purpose to replace a well established species with one whose authenticity rests on tenuous grounds. Therefore the designation A. gervaisii is retained.

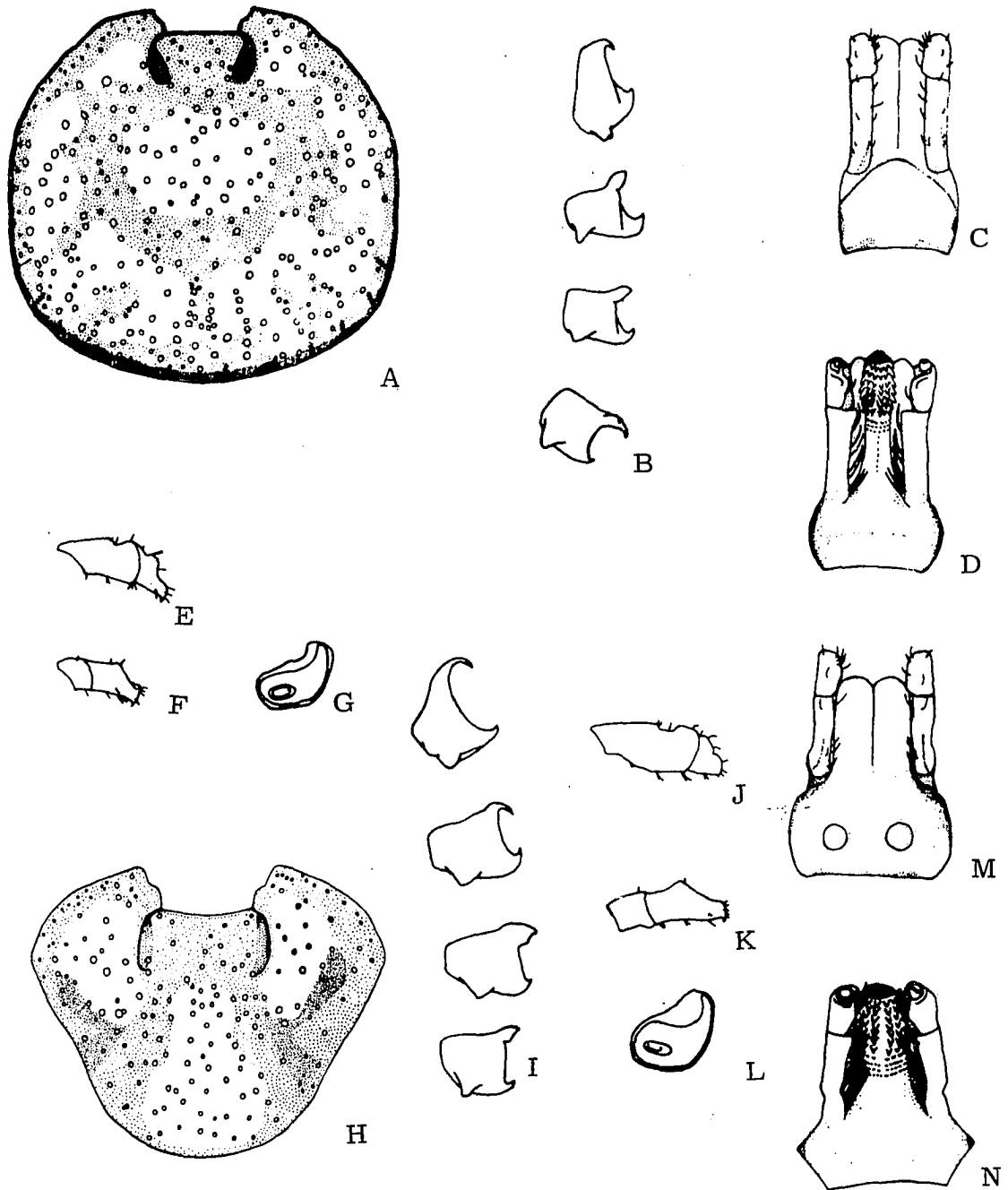
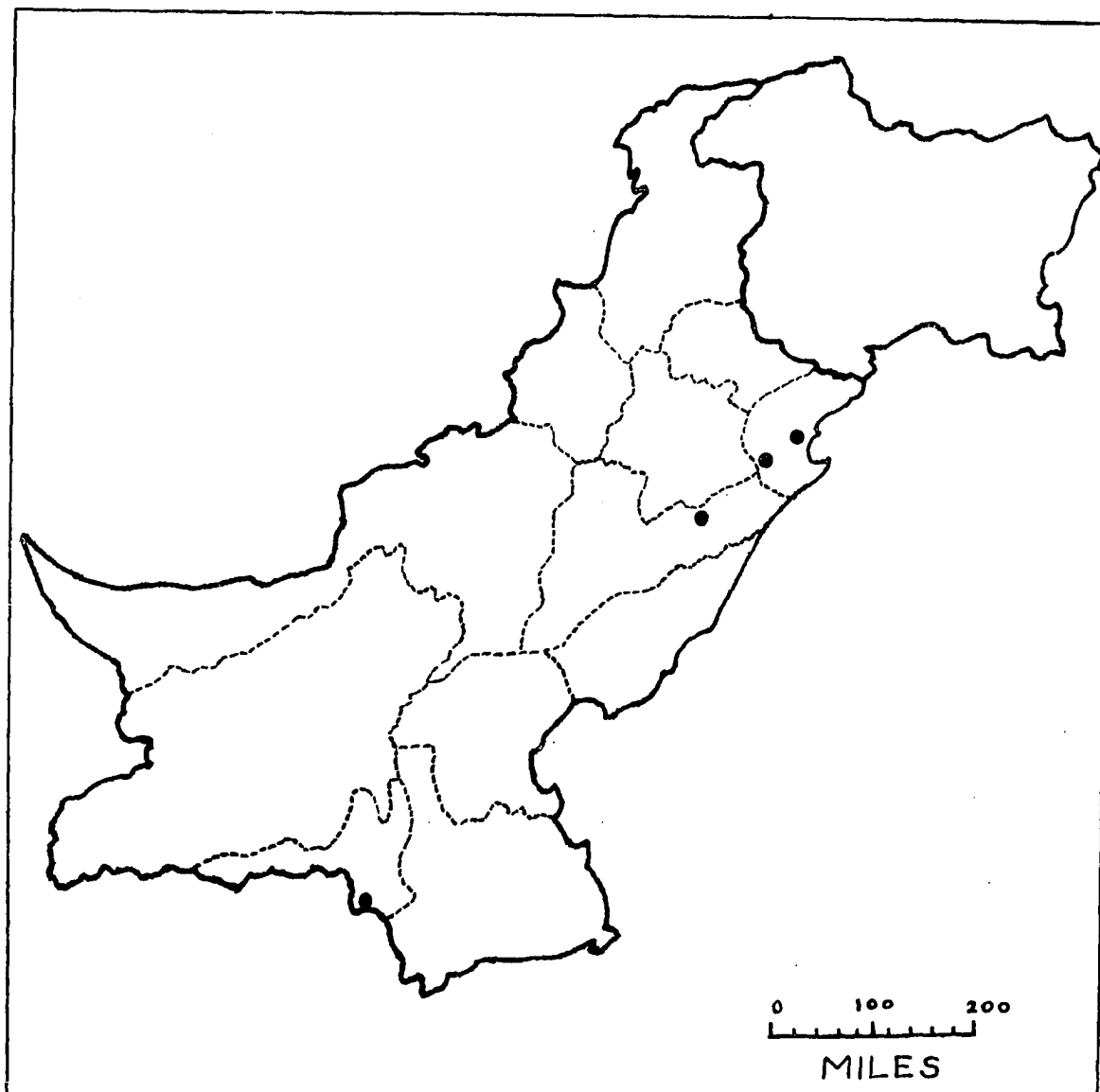


Fig. 2. *Aponomma gervaisii* (Lucas, 1847). A-G, male: A-scutum; B-coxae I-IV; C-capitulum, dorsal view; D-capitulum, ventral view; E-tarsus I; F-tarsus IV; G-spiracular plate. H-N, female: H-scutum; I-coxae I-IV; J-tarsus I; K-tarsus IV; L-spiracular plate; M-capitulum, dorsal view; N-capitulum, ventral view.



Map IV. Aponomma gervaisii (Lucas, 1847)  
Geographical distribution – West Pakistan

## GENUS BOOPHILUS CURTICE, 1891

### Introduction

Due to its world wide distribution and the great variation in some of its species, the subgeneric classification of this group remains in dispute. Cooley (1946), Anastos (1950), Hoogstraal (1956) and Arthur (1960) rejected the subgeneric divisions of Minning (1934), and limited the number of species to three. However, Zumpt (1951) and Theiler (1962) follow the system of Minning, and the latter also accepts the validity of additional African species.

The three commonly recognized species are: Boophilus annulatus, Boophilus decoloratus and Boophilus microplus. Hoogstraal and Kaiser (1960) described Boophilus kohlsi from Jordan; this species appears sufficiently distinct from the others to warrant acceptance.

Two species, B. annulatus and B. microplus, have been collected from West Pakistan.

### Key to the Males

Caudal process present .....	<u>microplus</u>
Caudal process absent .....	<u>annulatus</u>

### Key to the Females

Posterior of coxa I slightly emarginate with weak outer spur.

Traces of an inner spur may or may not be present.... annulatus

Posterior of coxa I strongly emarginate. Outer and inner spurs  
distinct and separated.....microplus

BOOPHILUS ANNULATUS (SAY, 1821)

Synonymy

Ixodes annulatus

Say, 1821, J. Acad. Nat. Sci., Philadelphia, 2: 75-76 (original description, from Cervus virginianus, Florida, U. S. A.).

Boophilus annulatus

Salmon and Stiles, 1901, U. S. Dept. Agric., Bur. Anim. Indust., 17 Ann. Rept., Washington: 420-426.

Boophilus annulatus subsp. calcaratus

Sharif, 1928, Rec. Indian Mus., 30 (3): 290 (from cattle and horse, Coorg, India).

Sen, 1938, Indian Jour. Vet. Sci. and Animal Husbandry, 8: 133-147 (from cattle, Mysore, India).

Hosts, Distribution and Biology

Cattle (12 collections), goats (4 collections) and buffalo (2 collections) serve as hosts of Boophilus annulatus in West Pakistan. Infestation of wild animals has not been reported here, but occurs in Africa (Hoogstraal, 1956) and North America (Cooley, 1946) on rare occasions.

B. annulatus has been recovered from several ecological areas in West Pakistan. Most of the material was collected in the areas in-



fluenced by the Arabian Sea and in the relatively dry but canal irrigated regions of the Indus basin. Occasional specimens were collected in the foothills of the Himalayas but in higher elevations north of Peshawar and Rawalpindi B. microplus is far more prevalent.

B. annulatus has been reported from North America, West Africa, Central Africa, the Sudan and Iran. Its distribution may be far more extensive, and this is discussed in the section "Remarks".

The distribution of B. annulatus in West Pakistan is spotty and irregular. Only 80 specimens were found in the more than 20,000 ticks collected from domestic animals throughout the country; 63 of these were collected in the general areas of Lahore and Karachi, which have a high cattle density. Other areas of cattle tick infestation yielded various species of Hyalomma. Collections of B. annulatus were made during the months of February, March, May, June, August, September and November.

As the biology of this tick has not been studied in West Pakistan, reference is made to the basic studies by Hunter and Hooker (1907) in the United States. According to them B. annulatus is a one host tick with a predilection for domestic stock, especially cattle. An engorged female tick will lay approximately 2,000 eggs three to 82 days after dropping off its host. Warm moist conditions favor the speed of this process. Incubation ranges from 17 days to six months and is also affected by both temperature and humidity. Several hours after hatching, the larvae climb up to the tips of vegetation and await the passing

of a suitable host. They may survive as long as 159 days on this location. Larvae commonly attach to the legs, belly or dewlap of the host, but in heavy infestations they may be found in any region. The larvae molt to nymphs seven to 12 days after attachment and the nymphs molt to adults five to ten days later. The adult female tick feeds for four to 14 days; during this time she is fertilized. Feeding completed, she drops to the ground, oviposits, and dies.

### Disease Relationship

B. annulatus is not known to attack man or to transmit any human pathogens. However, its ability to transmit Babesia bigemina in cattle constitutes an indirect public health menace in those countries which have a large cattle industry and are on a marginal nutritional level.

### Description - Male (Fig. 3, A-H )

1. Body. Small, ovate, broadest in posterior half. Seven specimens, 1.80 mm - 2.11 mm long, average 1.91 mm; width 0.90 mm - 1.05 mm, average 1.00 mm.

2. Scutum. Brown, 1.50 mm - 1.80 mm long, average 1.63 mm; width only slightly less than body width. Cervical grooves shallow, almost reaching twin elliptical depressions at mid-scutum near the lateral margins. Posteromedian and paramedian grooves present but extremely faint. Lateral grooves and caudal projection absent. Scapulae strong. Punctations rare and faint. Setae present on lateral

margins, posterior margin and between the cervical grooves on the anterior half of the scutum. Eyes small, nearly flat.

3. Venter. Genital aperture between coxae II. Anal aperture median, slightly below level of spiracular plates. Spiracular plates ovoid. Adanal shields, with small projection on inner posterior margin, and slight bulge on inner margin slightly below anal aperture. Accessory shields short, pointed. Venter covered with numerous fine setae.

4. Legs. Short, strong. Coxa I with a long anterior projection and two separated spurs on posterior margin; outer spur large and sharp, inner spur rounded and smaller. Coxae II, III with single, small comb spurs on posterior margins. Coxa IV without spur.

5. Capitulum. Length 0.33 mm - 0.44 mm, average 0.36 mm; width 0.43 mm - 0.45 mm, average 0.43 mm. Cornua variable, from minute to small. Posterior margin straight to slightly convex. Palps short, especially article 3. Article 3 with small ventral spur on inner, posterior margin.

6. Hypostome. Short, blunt, average length 0.20 mm. Dentition 4/4, teeth small, corona present.

#### Description - Female (Fig. 3, I-O)

1. Body. Small to medium sized. Ten specimens, length 2.10 mm (unengorged) - 7.30 mm (engorged); width 1.10 mm (unengorged) - 5.15 mm (engorged). Shape elongate, oval. Posteromedian and paramedian grooves present. Fine setae present on venter and dorsum, except for

grooves and central scutal regions.

2. Scutum. Orange brown. Length 0.95 mm - 1.18 mm, average 1.08 mm; width 0.75 mm - 0.88 mm, average 0.80 mm. Widest in region between eyes and bases of scapulae. Scapulae long and separated. Cervical grooves faint or absent in anterior region, becoming broad and distinct at posterolateral margins. Punctations rare, shallow. Setae few, scattered mainly in anterolateral regions. Eyes prominent, slightly bulging.

3. Venter. Genital aperture between coxae II. Anal aperture median, slightly below level of spiracular plates. Spiracular plates oval to subcircular.

4. Legs. Long, thin. Coxa I with a small outer spur and a small ridgelike remnant of an inner spur (sometimes absent). Coxae II, III and IV unarmed.

5. Capitulum. Length 0.42 mm - 0.53 mm, average 0.46 mm; width 0.58 mm - 0.70 mm, average 0.63 mm. Basis capituli hexagonal, cornua faint or absent. Palps small, especially article 3. Porose areas subtriangular to transversely oval.

6. Hypostome. Short with bluntly rounded apex. Average length 0.30 mm. Dentition 4/4, teeth small.

#### Remarks

The taxonomic relationship of B. annulatus to Boophilus calcaratus Birula, (1895) has yet to be fully defined. Arthur (1960) and

Abbassian-Lintzen (1960) place B. calcaratus in synonymy with B. annulatus. However Hoogstraal (1956) sounds a more cautious note, pointing out that while it is impossible to distinguish American or African populations of B. annulatus from those of North Africa, Southern Europe and the Near East which Minning (1934, 1935, 1936) called B. calcaratus, "the examination of pertinent specimen material is indicated to establish the validity of these identifications". This taxonomic problem is compounded by the acceptance of Minning's classification in the Soviet Union. While Pomerantsev (1950) does not accept Minning's subspecific divisions of B. calcaratus, he lists the species range as including the Soviet Union, southern Spain, France, Italy, the Balkan peninsula, Algeria, Tunisia, Palestine, Asia Minor and Iran. Sharif (1928) referred to Indian collections as B. annulatus calcaratus; a comparison of Pakistani and American material reveals slight differences between the two groups (e. g. In Pakistani males, rudimentary spurs are present on coxae II, III, a character that was also noted by Pomerantsev (1950) in his redescription of B. calcaratus). However, in view of the degree of variation found among individuals in the Pakistani collection, this group is here referred to simply as B. annulatus.

It is probable that B. annulatus is an introduced species and is not native to the region. Its relative scarcity and localized distribution indicate that the adaptation has not been too successful. Grebenyuk (1961) has reported B. calcaratus from southern Kirgizia, a region which lies 100 miles to the north of West Pakistan. This raises

the possibility of the introduction of this tick population into the country by the herds of nomadic tribesmen. Another possibility of boophilid introduction is by sea-shipped cattle via Karachi. The relatively heavy focus of infestation in this region tends to support this view.

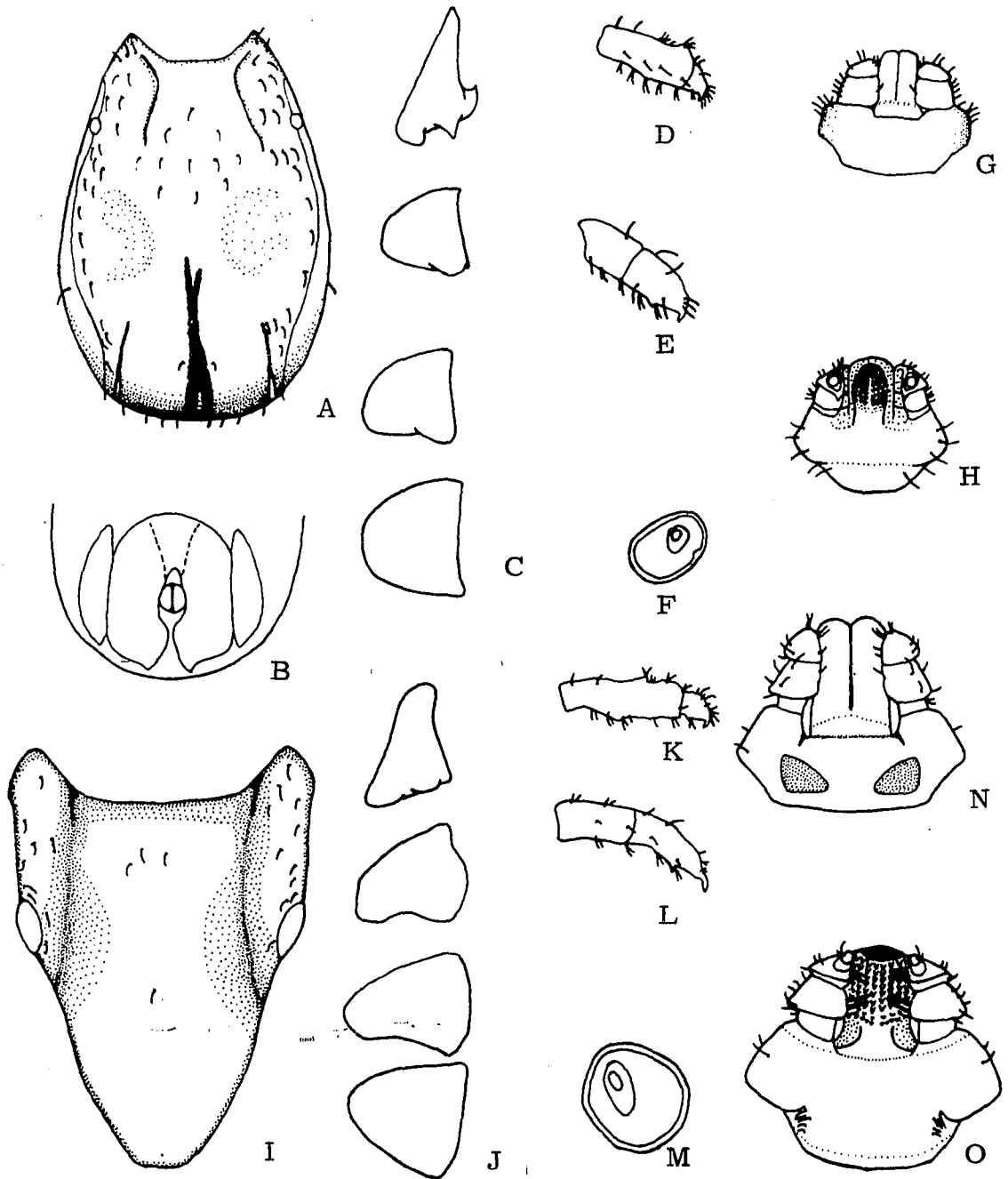
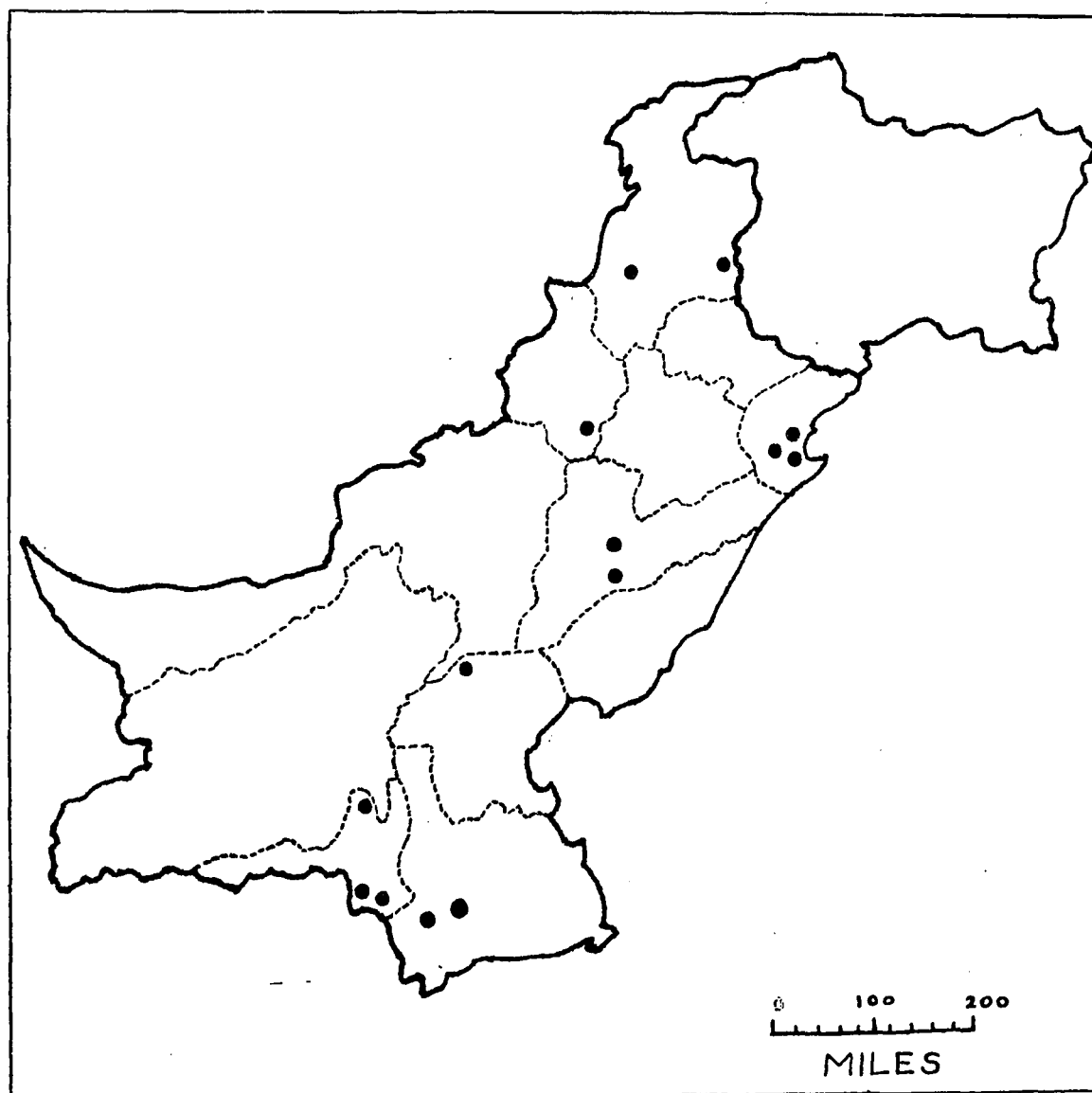


Fig. 3. Boophilus annulatus (Say, 1821). A-H, male: A-scutum; B-adanal and accessory anal shields; C-coxae I-IV; D-tarsus I; E-tarsus IV; F-spiracular plate; G-capitulum, dorsal view; H-capitulum, ventral view. I-O, female: I-scutum; J-coxae I-IV; K-tarsus I; L-tarsus IV; M-spiracular plate; N-capitulum, dorsal view; O-capitulum, ventral view.



Map V. *Boophilus annulatus* (Say, 1821)  
Geographical distribution – West Pakistan



BOOPHILUS MICROPLUS (CANESTRINI, 1888)

Synonymy

Haemaphysalis micropla

Canestrini, 1888, (1887), Atti Soc. Veneto-Trent. Sci. Nat., 11  
(1): 104-105 (Chaco Australe, Paraguay; type in Genoa  
Mus.).

Rhipicephalus australis

Fuller, 1899, Agric. Jour., Cape Town, 14 (6): 363-369 (Aus-  
tralia off horses and cattle).

Boophilus australis

Stiles and Hassall, 1901, U. S. Dept. Agric., Bur. Anim.  
Indust., Circ. 34: 2-3.

Sharif, 1928, Rec. Indian Mus., 30 (3): 284-289 (India off cattle,  
sheep, goat, horse, camel, Cervus muntjac and Bos fron-  
talis ).

Sen, 1938, Indian Jour. Vet. Sci. and Animal Husbandry, 8:  
133-147 (Murree off cattle, Rawalpindi off bullock).

Boophilus microplus

Bequaert, 1926, Med. Report H. Rice 7th Exped. Amazon (1924-  
1925), pp. 168-171.

Anastos, 1950, Ent. Amer., 30 (1-4): 144.

## Hosts, Distribution and Biology

Throughout the world, Boophilus microplus is most commonly found on domestic cattle. Sheep, goats, camels and horses serve as secondary hosts. In West Pakistan the hosts, in order of importance are cattle, buffalo, sheep and goats. Individual specimens were also collected from Lepus nigricollis, Ochotona royali and Canis familiaris.

B. microplus is found in South America, Central America, southern Florida, parts of southeastern Africa, Madagascar, Australia, Indonesia, the Philippine Islands, Burma, Nepal, India and Kashmir.

In West Pakistan it is common in the divisions of Peshawar, Rawalpindi and Lahore. It has also been collected from the divisions of Karachi, Hyderabad, Quetta, Multan, Bahawalpur and Sargodha.

B. microplus is commonly found in the Himalayan foothills north of Lahore, from Kashmir to Afghanistan. Less frequently it is found on the plains of the upper Indus basin, and occasionally in the sea influenced areas near Karachi. Collections were made throughout the year.

B. microplus is a one host tick. Its biology has not been studied in West Pakistan. Arthur (1960) cites several works in describing its life cycle, which in general is similar to B. annulatus.

## Disease Relationship

The vector potential of B. microplus has not been studied in West

Pakistan. Elsewhere it transmits Babesia bigemina, Babesia berbera and Anaplasma marginale to cattle, Babesia ovis to sheep, and Nuttallia equi to horses.

#### Description - Male (Fig. 4, A-H )

1. Body. Small, ovate, yellowish brown, with distinct protuberance on posterior. Twelve specimens, length 1.83 mm - 2.60 mm, average 2.30 mm; width 1.00 mm - 1.30 mm, average 1.23 mm.

2. Scutum. Yellow to reddish brown, elongate, does not cover lateral margins of anterior 3/4 of the body. Length 1.65 mm - 2.28 mm, average 1.99 mm; width 0.88 mm - 1.15 mm, average 1.04 mm. Cervical grooves greatly reduced, posteromedian and paramedian grooves present but shallow. Twin oval depressions located above paramedians midway on the scutum. Scapulae long and prominent. Setae heavy on lateral margins, and anterior median region. Posteromedially two rows of setae parallel the median line. Eyes small, inconspicuous.

3. Venter. With heavy covering of fine setae. Genital aperture between coxae II. Adanal shields long, terminating with a small spur on posteromedian edge. Accessory shields prominent, straight to comma-shaped. Both sets of shields usually do not reach the posterior edge of the scutum. Spiracular plates ovoid.

4. Legs. Moderate, becoming progressively thicker from leg I to leg IV. Coxa I with long anterior projection and two posterior

spurs; the inner spur larger and rounded, the outer small and sharp. Coxa II has a single moderate, sharp spur. Coxa III has a small rounded spur. Coxa IV lacks spurs.

5. Capitulum. Length 0.30 mm - 0.43 mm, average 0.35 mm; width 0.40 mm - 0.53 mm, average 0.48 mm. Basis capituli hexagonal, cornua small, posterior margin straight. Many setae on lateral regions of basis capituli and on palps. Palps small, especially article 3.

6. Hypostome. Short, average length 0.26 mm, anterior bluntly rounded. Dentition 4/4, teeth small.

#### Description - Female (Fig. 4, I—O )

1. Body. Ten specimens, length 2.55 mm (unengorged) - 9.05 mm (engorged); width 1.40 mm (unengorged) - 5.30 mm (engorged).

2. Scutum. Subtriangular, widest in anterior third. Length 0.98 mm - 1.20 mm, average 1.11 mm; width 0.75 mm - 1.00 mm, average 0.87 mm. Scapulae long, large. Eyes distinct. Cervical grooves shallow, broadening posteriorly and reaching posterior scutal margin. Setae mainly restricted to anterior third of scutum.

3. Venter. Genital aperture between coxae II. Raised surfaces with numerous setae. Spiracular plates ovoid.

4. Legs. Long, strong. Coxa I with anterior projection, shorter but thicker than that of males; two posterior spurs separated by deep cleft, outer spur slightly wider than inner. Coxae II, III with small rounded outer spurs, coxa IV with minute rounded outer spur.

5. Capitulum. Length 0.41 mm - 0.48 mm, average 0.45 mm; width 0.65 mm - 0.78 mm, average 0.70 mm. Basis capituli hexagonal, cornua variable, small to absent. Posterior margin of basis straight. Palps small, especially article 3.

6. Hypostome. Average length 0.31 mm, with slight apical notch. Dentition 4/4, teeth small.

#### Remarks

This species was reported by Sharif (1928) from Hazara, and by Sen (1938) from Kashmir. Both writers identified it as Boophilus australis (Fuller, 1899). Today most workers regard B. australis as a synonym of B. microplus.

While it is relatively simple to separate males of B. microplus from males of B. annulatus, it is sometimes more difficult to separate the females. The major character is the degree and nature of the separation of the two spurs on coxa I. Proper cleaning of the specimen and positioning of the light source will enable one to use this character successfully in nearly all cases; however, occasional specimens have been found which appear to be intermediate between the two species in this character.

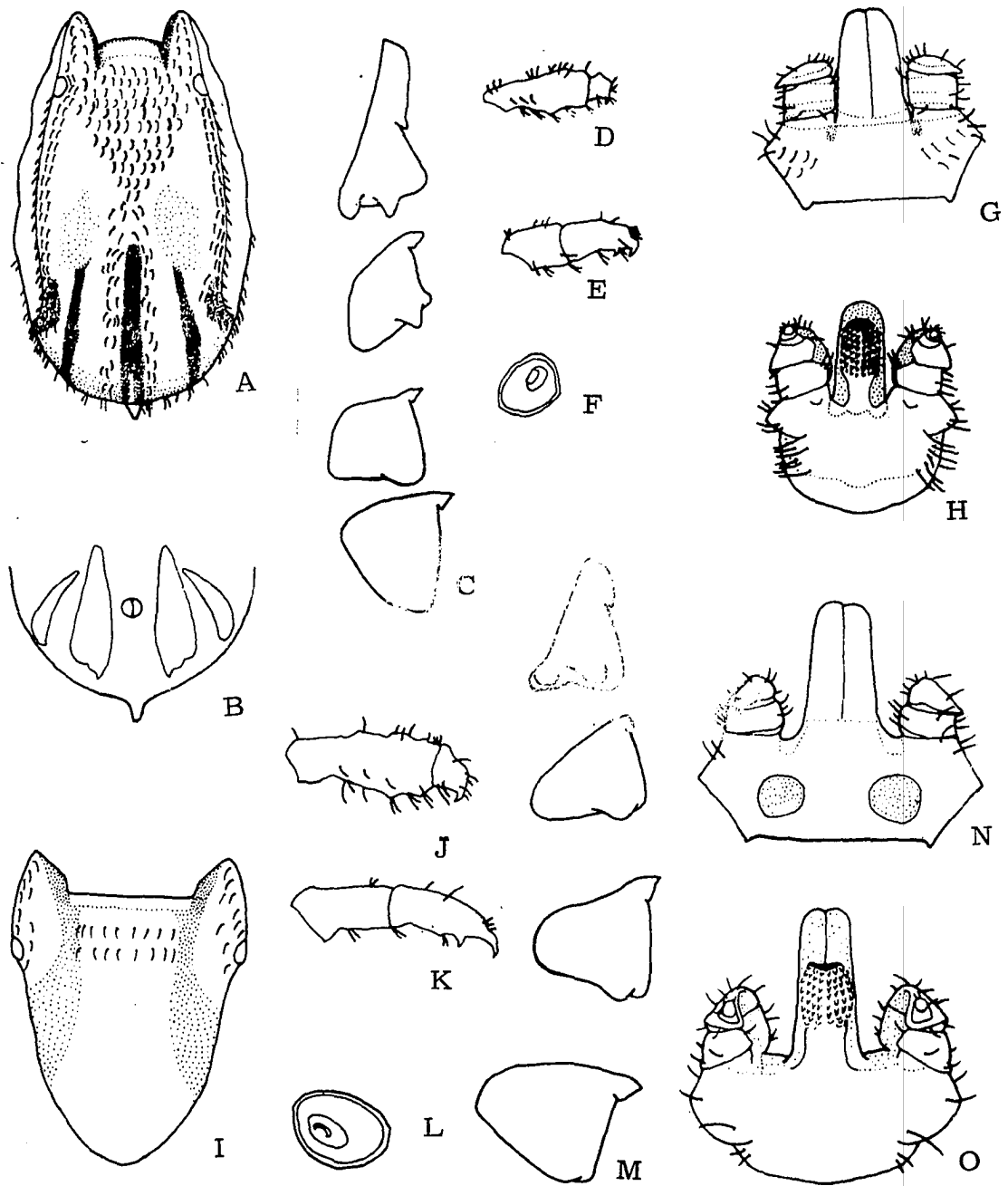
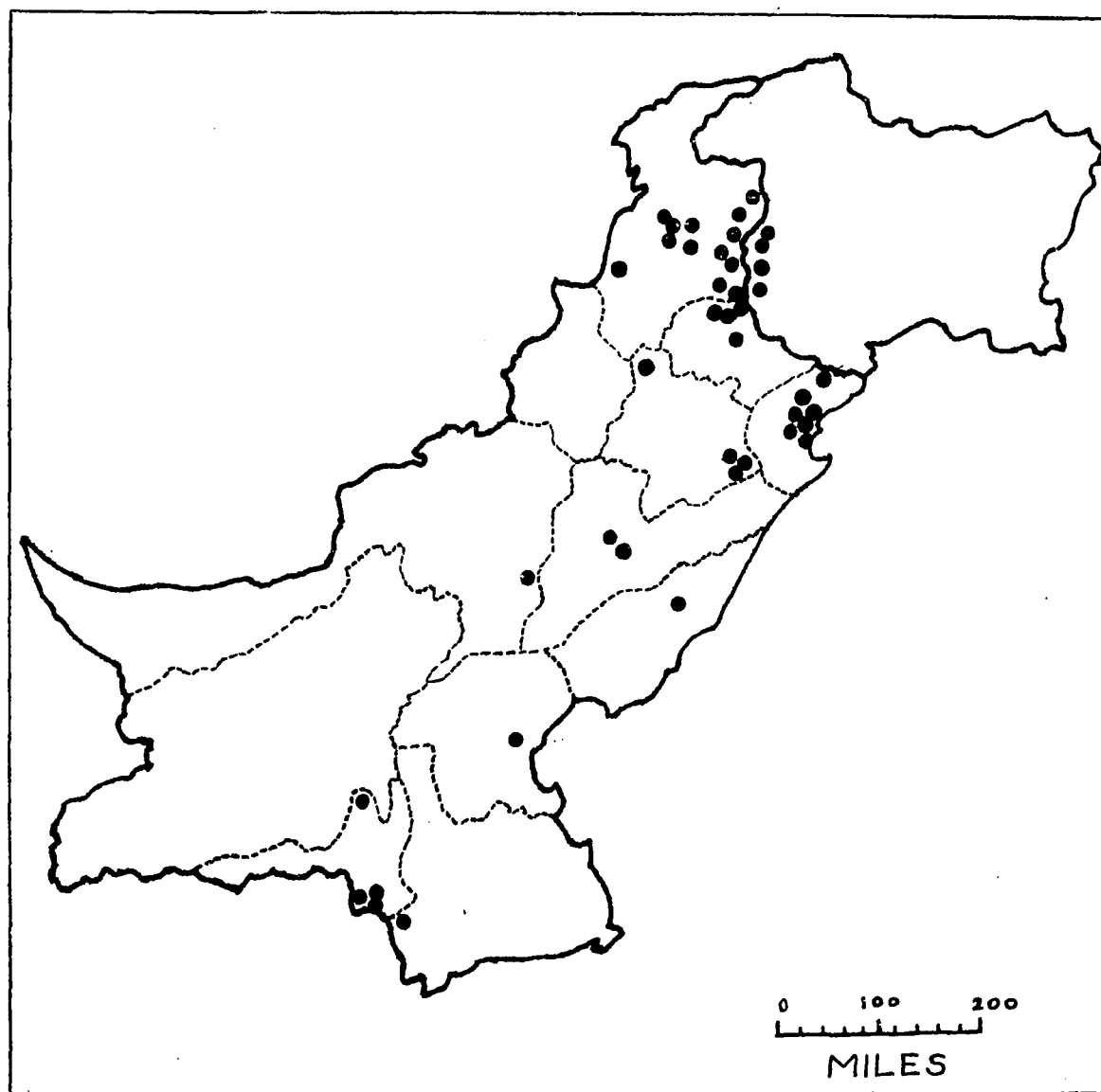


Fig. 4. *Boophilus microplus* (Canestrini, 1888). A-H, male: A-scutum; B-adanal and accessory anal shields; C-coxae I-IV; D-tarsus I; E-tarsus IV; F-spiracular plate; G-capitulum, dorsal view; H-capitulum, ventral view. I-O, female: I-scutum; J-tarsus I; K-tarsus IV; L-spiracular plate; M-coxae I-IV; N-capitulum, dorsal view; O-capitulum, ventral view.



Map VI. Boophilus microplus (Canestrini, 1888)  
Geographical distribution — West Pakistan

## GENUS DERMACENTOR KOCH, 1844

### Introduction

This genus has not been previously reported from the areas which now comprise West Pakistan.

## DERMACENTOR RASKEMENSIS POMERANTSEV, 1946

### Synonymy

#### Dermacentor raskemensis

Pomerantsev, 1946, Opred. Faune SSSR Zool. Muz. Akad.

Nauk, Leningrad, 26: 16.

Pomerantsev, 1948, Parazitol. Sborn. Zool. Inst. Akad. Nauk

SSSR, 10: 23, 24.

Pomerantsev, 1950, Fauna of the USSR, 4 (2): 164.

### Hosts, Distribution and Biology

Domestic sheep and goats serve as hosts for the adult stage of Dermacentor raskemensis. Immature stages have been collected from Ochotona rufescens.

Adults of Dermacentor raskemensis have been collected from March to October, at elevations ranging from 6,000 to 8,000 ft. in the north-central part of West Pakistan. Nymphs and one larva were col-



lected from the same general area during July.

D. raskemensis was collected in the Ziarat Region in Quetta Division, and in the Urrak Region near Quetta City.

Outside of West Pakistan D. raskemensis is known only by one male collected in November in Sintszian, Raskem District, USSR.

#### Disease Relationship

Unknown.

#### Description - Male (Fig. 5, A-G )

1. Body. Medium sized. Six specimens, length 3.9 mm - 5.2 mm, average 4.8 mm; width 2.2 mm - 3.2 mm, average 2.7 mm.

2. Scutum. Elongate, oval, narrowing anteriorly and widest at posterior third. Length 3.4 mm - 4.6 mm, average 4.2 mm; width same as body width, occasionally slightly narrower. Color, cream white, dark brown in regions of grooves and depressions. Cervical grooves shallow, short, appearing to extend one-third the scutal length as brown stripes. Lateral grooves extending anteriorly from first festoons to 0.5 mm below the eyes. Festoons prominent. Postero-median and paramedian grooves represented by dark brown patches. Eyes marginal, slightly convex. Punctations shallow, small to medium size, distributed over entire scutum.

3. Venter. Yellowish brown, heavy covering of fine white setae. Genital aperture between coxae II. Anal aperture below posterior

margins of coxae IV. Spiracular plates thick comma-shaped; posterior margin of dorsal prolongation straight to slightly concave.

4. Legs. Legs strong, dorsal surface with white enamel coat. Coxa I with two posterior spurs of approximately equal length; outer spur narrow and bluntly pointed, inner spur wide and broadly curved. Coxae II - IV with narrow, single spurs. Coxa IV elongate, half again longer than wide.

5. Capitulum. Rectangular. Dorsum with partial cover of white enamel and scattered punctations. Length 0.8 mm - 0.9 mm, width 0.5 mm - 0.6 mm. Palps short, strong. Article 2 with small, caudally directed, dorsal spur. Cornua strong, curved and dull.

6. Hypostome. Moderate, average length 0.4 mm. Dentition 3/3, teeth small.

#### Description - Female (Fig. 5, H-N )

1. Body. Dark brown. Seven specimens, length 4.0 mm (unengorged) - 15.0 mm (engorged); width 2.1 mm (unengorged) - 8.4 mm (engorged). Marginal grooves, festoons, posteromedian and paramedian grooves all prominent in unengorged specimens. Setae sparse on dorsum.

2. Scutum. White, subovate, broadly angular posterior margin. Longer than wide. Length 1.6 mm - 2.0 mm, average 1.8 mm; width 1.4 mm - 1.8 mm, average 1.7 mm. Cervical grooves short and deep. Two areas of dark brown pigmentation start slightly posterior to the cervical grooves and extend posterolaterally to the posterior third of the scutum. Scapulae strong. Punctations small, numerous and evenly distributed over the scutum. Eyes weakly convex, promin-

ent on lateral margins.

3. Venter. Brown. Genital aperture narrowly triangular, located between posterior margins of coxae II. Anal aperture just below level of posterior margins of spiracular plates. Spiracular plates subcircular, with short, thick dorsal prolongations, posterior margins straight. Moderate number of small setae evenly distributed on body.

4. Legs. Strong, longer than those of male, covered dorsally with white enamel. Coxae I - IV spurred as those of the male. Coxa IV not elongate.

5. Capitulum. Similar to that of the male. Average length 0.8 mm, average width 0.6 mm. Palps similar to those of the male, but with heavier punctation. Cornua shorter than those of the male. Porose depressions of basis capituli deep and oval.

6. Hypostome. Moderate, average length 0.4 mm. Dentition 3/3, teeth moderate.

#### Remarks

D. raskemensis bears a superficial resemblance to Dermacentor everestianus Hirst, 1926 and Dermacentor abaensis Teng, 1963; but can be separated from them by the shape and development of the cornua on the basis capituli, and the shape and development of the dorsal spur on palpal article 2.

While the type specimen was not available for study, the identification of the Pakistani material was confirmed by Dr. N. A. Filippova

and Dr. Harry Hoogstraal.

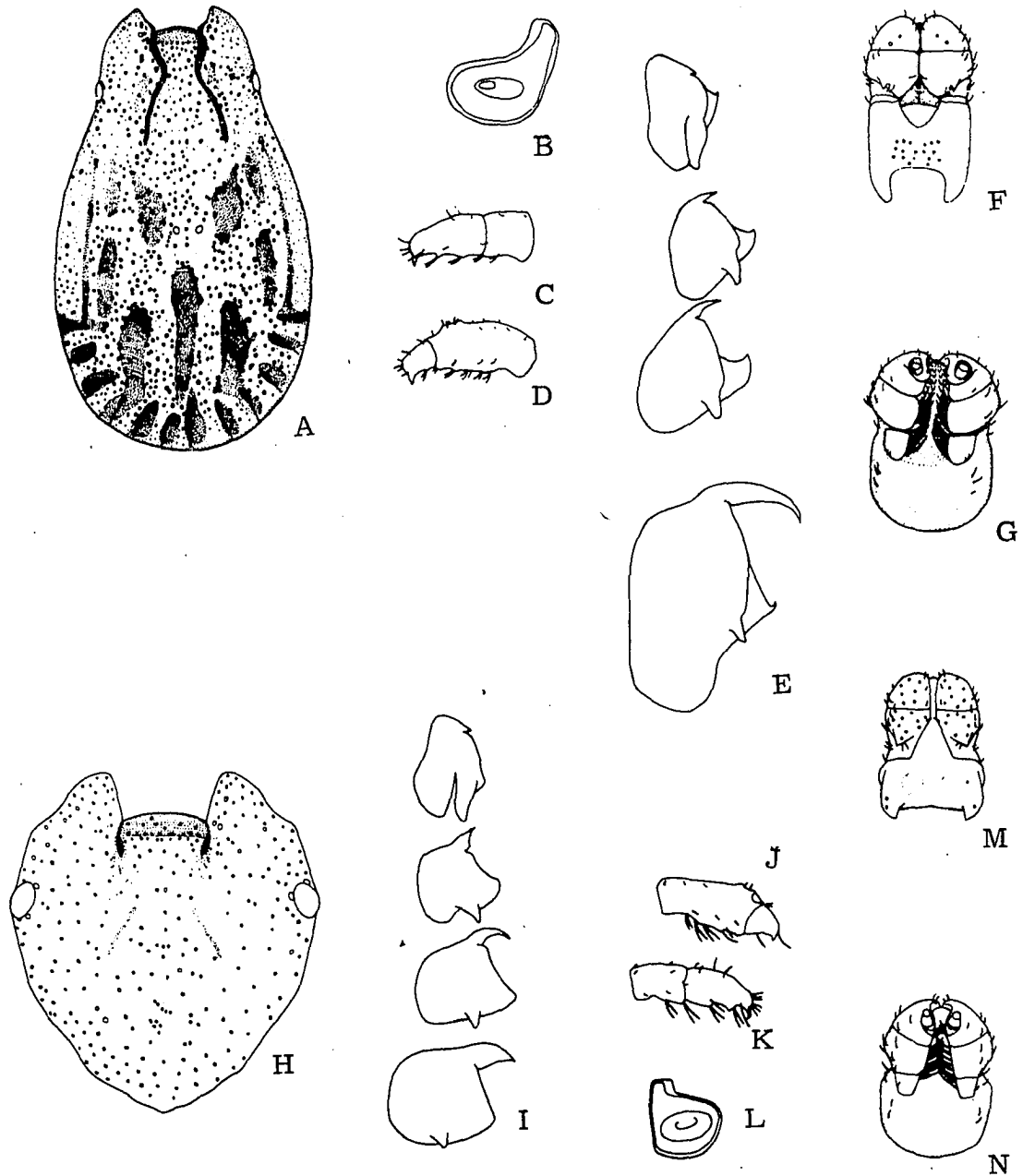
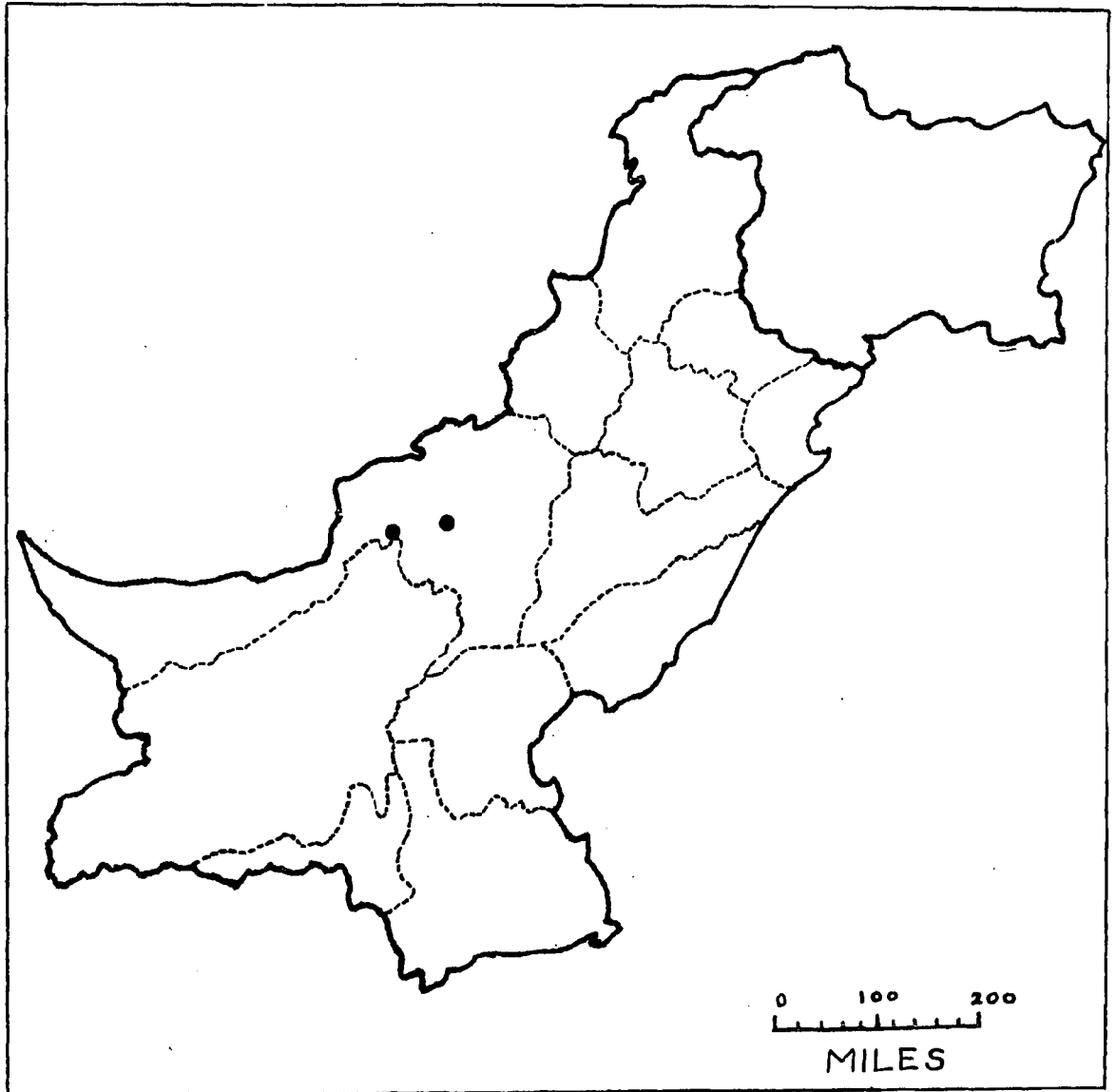


Fig. 5. Dermacentor raskemensis Pomerantsev, 1946. A-G, male: A-scutum; B-spiracular plate; C-tarsus I; D-tarsus IV; E-coxae I-IV; F-capitulum, dorsal view; G-capitulum, ventral view. H-N, female: H-scutum; I-coxae I-IV; J-tarsus I; K-tarsus IV; L-spiracular plate; M-capitulum, dorsal view; N-capitulum, ventral view.



Map VII. Dermacentor raskemensis Pomerantsev, 1946  
Geographical distribution — West Pakistan

## GENUS HAEMAPHYSALIS KOCH, 1844

### Introduction

This genus ranks second only to Hyalomma in the number of species collected in West Pakistan. Ten species have been reported and it is probably that additional species have been overlooked as members of this genus are usually small, found sporadically on a wide variety of wild mammals and birds, and irregularly distributed. Most haemaphysalids have been found in small numbers and only two or three species appear to be common on domestic animals.

Hoogstraal (1964) noted that the genus Haemaphysalis consists of approximately 115 species and subspecies. This great diversity of form has caused much taxonomic confusion, and the genus as a whole is sorely in need of revision.

### Key to the Males

1. Palpi markedly salient laterally, article 2 much wider than long . . . . . 2
- Palpi slightly to moderately salient laterally, article 2 at best slightly wider than long . . . . . 3
2. Palpal article 2 with dorsal and ventral spurs on posterior margin . . . . . leachii
- Palpal article 2 lacking spurs on posterior margin, lateral

- salience flared..... erinacei turanica
3. Spur on coxa IV markedly longer than those of coxae I, II, or  
III..... 4
- Spur on coxa IV equal to or smaller than those of coxae I, II,  
or III ..... 5
4. Spur on coxa IV longer than rest of coxa; scutum oval, widest  
in midregion..... cornupunctata
- Spur on coxa IV shorter than rest of coxa; scutum elongate  
oval, widest in posterior third; body frequently indented at  
level of dorsal spiracular projections; festoons frequently  
distended..... sulcata
5. Palpal article 2 with prominent spur on posteroventral  
margin..... montgomeryi
- Palpal article 2 without spur on posteroventral margin.... 6
6. Palpal article 3 with spur on posterodorsal margin ..... 7
- Palpal article 3 without spur on posterodorsal margin..... 8
7. Dorsal spur of article 3 near middle of posterior margin,  
ventral spur short and wide; scutal punctations small .....  
..... bispinosa
- Dorsal spur of article 3 at junction of posterointernal margin,  
ventral spur long and narrow, extending almost to posterior  
margin of article 2; scutal punctations large ..... intermedia
8. Coxal spurs strongly recurved laterally; cornua strong,  
elongately triangular ..... kashmirensis



- Coxal spurs straight (or nearly so); cornua weak to moderate  
 ..... 9
9. Posterointernal margin of palpal article 3 broadly curved,  
 extending beyond internal margin of article 2; coxal spurs  
 strong, short, wide and subequal; spiracular plates tear-  
 shaped..... kutchensis
- Juncture of posterior and internal margins of palpal article  
 3 angulated, inner margins of articles 2 and 3 continuous;  
 coxal spurs weak, that of coxa I longest; spiracular plates  
 subquadrangular ..... howletti

#### Key to the Females

1. Palpi markedly salient laterally, article 2 wider than long ..  
 ..... 2
- Palpi moderately salient laterally, article 2 usually longer  
 than wide..... 3
2. Palpal article 2 with dorsal and ventral spurs on posterior  
 margins..... leachii
- Palpal article 2 lacking spurs on posterior dorsal and ventral  
 margins, lateral saliences strongly flared. . erinacei turanica
3. Palpal article 2 with prominent spur on posteroventral  
 margin..... montgomeryi
- Palpal article 2 without prominent spur on posteroventral  
 margin..... 4

4. Palpal article 3 with prominent spur on posterodorsal margin..... 5  
 Palpal article 3 without prominent spur on posterodorsal margin..... 6
5. Dorsal spur near posterointernal juncture of palpal article 3 ..... intermedia  
 Dorsal spur near middle of posterior margin of palpal article 3 ..... bispinosa
6. Inner posterodorsal margin of palpal article 3 broadly curved, extending past inner margin of article 2 ..... kutchensis  
 Inner posterodorsal margin of palpal article 3 angulated, not extending past inner margin of article 2 ..... 7
7. Lateral salience of palpal article 2 strongly flared.....  
 ..... howletti  
 Lateral salience of palpal article 2 usually not flared (at best only slightly flared) ..... 8
8. Coxal spurs short, pointed, subequal, recurved and directed laterally; scutum rounded oval..... kashmirensis  
 Coxa I with short, triangular spur, coxae II - IV with poorly developed, broad, comblike ridges; scutum ovate with broadly angulated posterior margin ..... sulcata  
 Coxae I, IV with short triangular spurs, coxae II, III with larger, widely triangular spurs; scutum shield-shape, widest in anterior third, lateral margins sinuous .... cornupunctata

HAEMAPHYSALIS BISPINOSA NEUMANN, 1897

Synonymy

Haemaphysalis bispinosa

Neumann, 1897, Mém. Soc. Zool. France, 10: 341-342, 358.

Warburton, 1908, Proc. Cambridge Philos. Soc., 14 (5): 517-518.

Nuttall and Warburton, 1915, Ticks, Pt. 3: 426-433.

Sharif, 1928, Rec. Indian Mus., 30 (3): 255-258.

Anastos, 1950, Ent. Amer., 30 (1-4): 26-30.

Anastos, 1957, U. S. Pub. Health Serv. Publ. No. 548: 92-93.

Trapido, et al., 1964, Bull. Ent. Res., 55 (2): 249-270.

Haemaphysalis neumanni

Dönitz, 1905, S. B. Ges. Naturf. Fr., Berlin, 4: 105-134.

Pomerantsev, 1950, Fauna of the USSR, 4 (2): 123-125.

Haemaphysalis bispinosa neumanni

Pospelova-Shtrom, 1939, Parazitol. Sborn. Zool. Inst. Akad.

Nauk SSSR, (7): 71-99.

Hosts, Distribution and Biology

Haemaphysalis bispinosa has been collected from all domestic animals and from a wide variety of wild animals (Nuttall and Warburton, 1915, Anastos, 1950 and 1957). In West Pakistan adults have been collected from domestic cattle and goats, and from Axis porcinus porcin-

us, Sus scrofa cristatus and Lepus nigricollis during April, May and June from scrub desert areas near Khairpur and in hill forests in Azad Kashmir.

This species has been reported from China, Burma, India, Japan, Indonesia, Australia, East Africa and the Soviet Union. In West Pakistan it has been collected near Khairpur and Tajjal in Khairpur Division and from the Neelum Valley, Kohala and Muzaffarabad in Azad Kashmir.

Anastos (1957) cites Soviet work showing that H. bispinosa can reproduce parthenogenetically; other data indicates a high degree of variability in rate of development of eggs from females which had fed on differing hosts. When fed on guinea pigs larvae fed for 3 - 4 days and moulted 10 - 14 days after dropping from the host. The nymphs engorged in four days, dropped off their guinea pig host after three days and moulted 17 - 20 days later. In the Soviet Union all stages were found during the warm season (May - October) in southern forest zones.

#### Disease Relationship

The virus of Kyasanur Forest disease has been isolated from H. bispinosa in Mysore. However the role of this tick in the transmission cycle has yet to be elucidated.

Sharif (1938) listed H. bispinosa as a suspected vector of Babesia bigemina in Australia and B. motasi in Mysore.

## Description - Male (Fig. 6, A-G)

1. Body. Pale yellowish brown. Two specimens, average length 2.1 mm, average width 1.3 mm.
2. Scutum. Elongate oval, widest in midregion. Average length 1.8 mm, average width 1.3 mm. Cervical grooves shallow, minute. Lateral grooves shallow, starting at midscutum and extending posteriorly past the first festoons. Festoons prominent, longer than wide. Punctations small, numerous and uniformly distributed. Eyes absent.
3. Venter. Genital aperture between coxae II. Spiracular plates ovate and narrowing anteriorly, with many small goblets.
4. Legs. Long and thick. Coxa I with a single medium length, bluntly pointed spur. Coxae II - IV with single, wide, medium length, bluntly rounded spurs.
5. Capitulum. Average length 0.4 mm, average width 0.4 mm. Palps small and slightly salient. Article 3 with a short, wide, sharp, retrograde spur on its posterodorsal margin and a long, sharp spur on its posteroventral margin. Basis capituli rectangular, wider than long. Cornua long, broad and prominent.
6. Hypostome. Short and blunt. Average length 0.2 mm. Dentition 4/4, teeth small.

## Description - Female (Fig. 6, H-N)

1. Body. Light yellow brown to dark brown. Five specimens,

length 2.8 mm (unengorged) - 8.1 mm (engorged); width 1.7 mm (unengorged) - 5.3 mm (engorged).

2. Scutum. Subcircular, widest in midregion. Length 0.9 mm - 1.0 mm, width 0.9 mm - 1.0 mm. Cervical grooves start as shallow pits and extend as shallow depressions into the posterior third of the scutum. Punctations small, numerous and uniformly distributed. Eyes absent.

3. Venter. Genital aperture between posterior borders of coxae III. Spiracular plates subcircular with many small goblets.

4. Legs. As in the male.

5. Capitulum. Average length 0.5 mm, average width 0.5 mm. Palps similar to those of the male, but lateral saliences sharper, more pronounced. Basis capituli wider than that of the male, similar in other respects. Porose areas large, rounded, shallow and widely separated.

6. Hypostome. Short and blunt, average length 0.2 mm. Dentition 4/4, teeth small.

#### Remarks

Sharif (1938) reported that H. bispinosa was common throughout pre-partition India "excluding the North-Western Provinces". Collections in West Pakistan revealed only a few specimens from Khairpur Division, however this tick appears to be fairly common in Azad Kashmir.

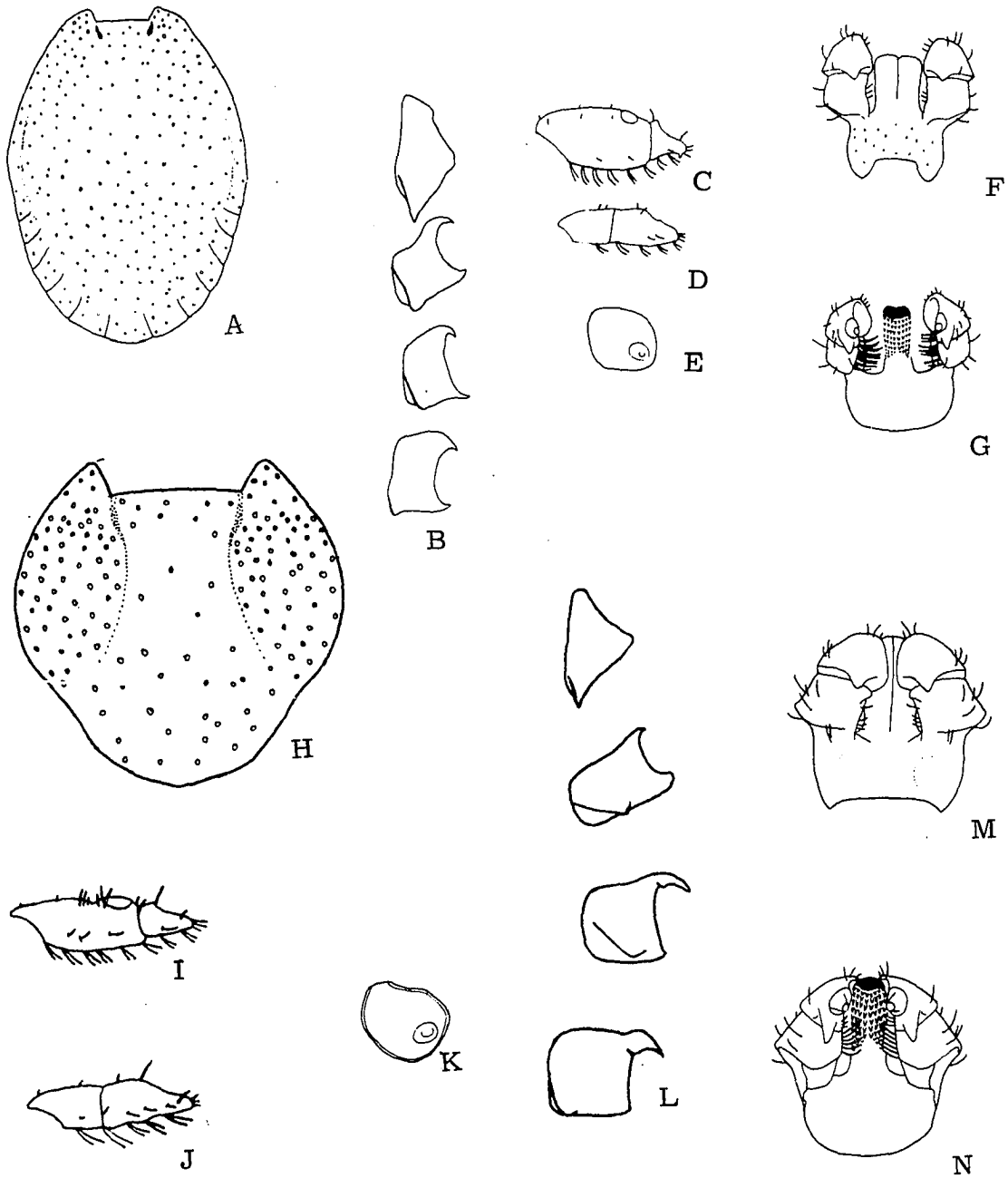
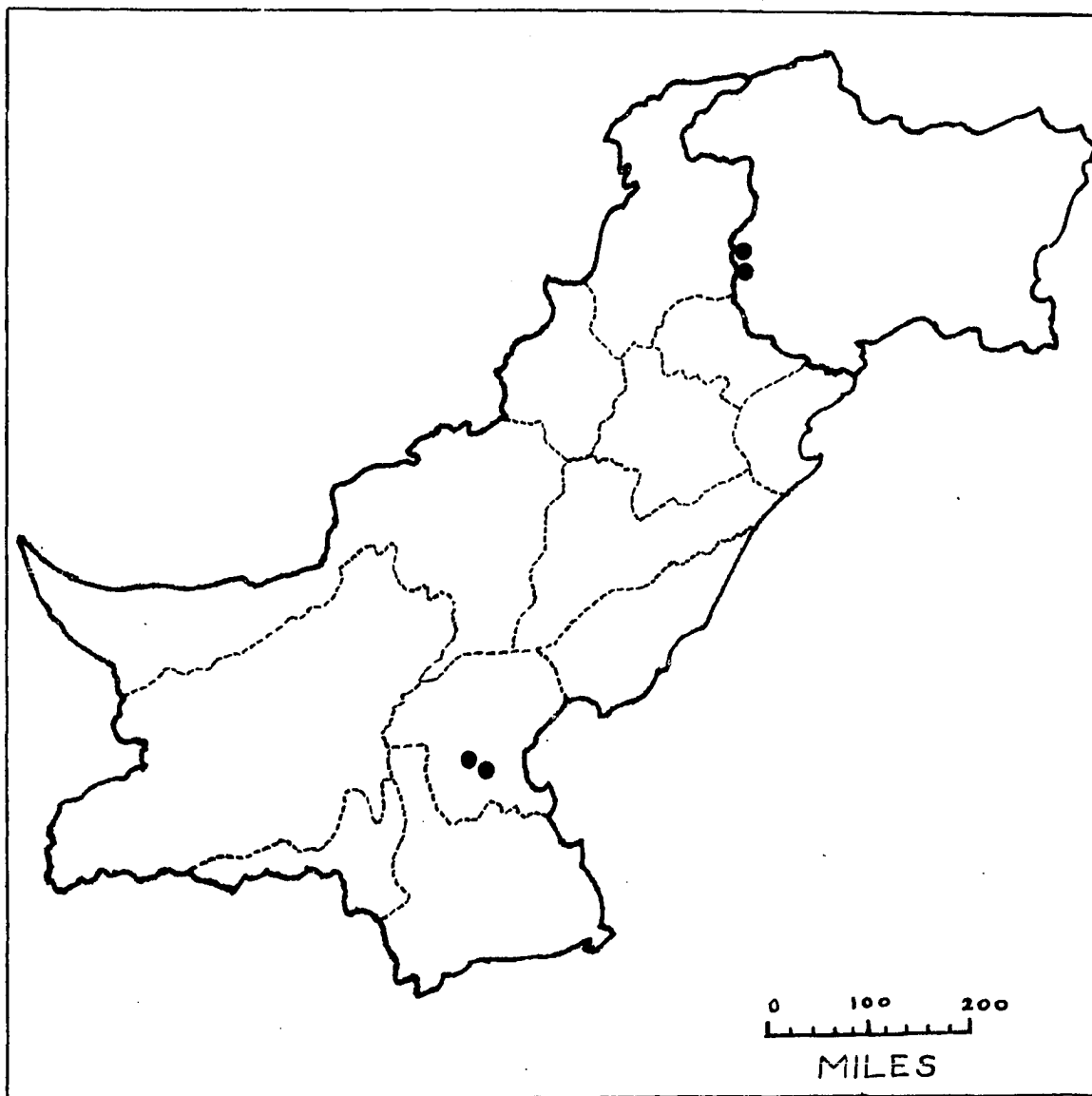


Fig. 6. *Haemaphysalis bispinosa* Neumann, 1897. A—G, male: A—scutum, B—coxae I—IV, C—tarsus I; D—tarsus IV; E—spiracular plate; F—capitulum, dorsal view; G—capitulum, ventral view. H—N, female: H—scutum; I—tarsus I; J—tarsus IV; K—spiracular plate; L—coxae I—IV; M—capitulum, dorsal view; N—capitulum, ventral view.



Map VIII. Haemaphysalis bispinosa Neumann, 1897  
Geographical distribution — West Pakistan



HAEMAPHYSALIS CORNUPUNCTATA HOOGSTRAAL and VARMA, 1962

Synonymy

Haemaphysalis cornupunctata

Hoogstraal and Varma, 1962, J. Parasit., 48 (2): 185-194.

Hosts, Distribution and Biology

Haemaphysalis cornupunctata adults were collected from several regions near Srinagar in Kashmir during April and May at altitudes of 7,000 - 8,000 ft. Hosts were sheep and goats.

In West Pakistan adults have been collected from domestic sheep and a wild goat near Saidu Sharif in Swat in April. Immature stages have been collected from a domestic cow, wild goat, Cricetulus sp., Apodemus sp. and Alticola sp. in the Babusar and Phandar regions of Gilgit, Gitudas in the Kagan Valley and near Saidu Sharif in Swat. These collections were made in April, July and September.

Disease Relationship

Unknown.

Description - Male (Fig. 7, A-G)

1. Body. Reddish brown. Two specimens, length approximately 3.2 mm, width approximately 1.6 mm.

2. Scutum. Elongate oval, widest at level of coxae IV. Length approximately 2.6 mm, width approximately 1.6 mm. Cervical grooves deep, at first slightly converging, then extending as shallow, diverging furrows to level of anterior ends of the lateral grooves. Lateral grooves long, somewhat superficial but nevertheless distinct, extending from the level of coxae II to the posterior margin of the second festoon. Punctations superficial, comparatively few, mixed small and medium size; widely spaced over scutal surface, lateral ridges and festoons. Eleven festoons prominent and clearly separated. Eyes absent.

3. Venter. Genital aperture between coxae II. Spiracular plate tear-shaped, with a short but prominent dorsal projection.

4. Legs. Robust. Coxal spurs dissimilar; spur of I short, wide, extending very slightly beyond coxal apex; spurs of II to IV arising adjacent to internoposterior corner, that of II slightly larger than I and that of III slightly larger than II; spur of IV huge, swordlike, reaching to level of midlength of anus.

5. Capitulum. Basis capituli rectangular, lateral margins very slightly convex, converging distally as they form cornua; posterior margin centrally straight, laterally curving into cornua; length (including cornua) approximately  $2/3$  of width; surface with few scattered punctations anteriorly; cornua robust, approximately half as long as base, widely triangular with more or less sharply pointed apices. Palpi with conical outline. Dorsum of article 1 obscure; article 3 approximately

half as long as the greatest length of article 2; article 2 bearing three setae, article 3 bearing approximately six setae. Ventrally, article 3 with a short, wide, bluntly pointed, slightly sinuous, retrograde spur protruding at almost right angles from surface of palpi; article 2 with three sublateral setae and a row of ten or eleven featherlike setae arising from inner margin; article 3 with six or seven setae on surface and two slightly expanded setae on inner surface; article 1 visible as a narrow, bulbous base.

6. Hypostome. Moderately stout and bluntly rounded. Dentition 4/4, teeth small.

#### Description - Female (Fig. 7, H-N)

1. Body. Reddish brown. One specimen, length (unengorged) approximately 3.7 mm, width (unengorged) approximately 2.2 mm.

2. Scutum. Shield-shape. Length approximately 1.2 mm, width approximately 1.0 mm. Scutal outline widely diverging for anterior third of length, thence more or less abruptly and slightly sinuously narrowing to a bluntly rounded posterior margin. Cervical grooves deep, concave, extending slightly beyond midlength of scutum. Surface more or less rugose anterolaterally. Punctations larger and deeper than those of male, rather numerous in anterolateral areas, becoming smaller and more sparse posteriorly.

3. Venter. Genital aperture slightly below posterior margins of coxae II. Spiracular plates subcircular with wider dorsal projections

than those of the male.

4. Legs. Coxae with spurs on I to III similar to but slightly larger than respective spurs of male; coxa IV with a comparatively narrow spur approximating that of III in length.

5. Capitulum. Resembles that of the male but somewhat larger in size. Palpal article 3 with short, ventral, retrograde spur, which does not reach the basal margin of the article. Basis capituli with short, widely triangular cornua; porose areas somewhat variable, moderate to very large, subcircular, separated from each other by distance equaling approximately half the width of one area.

6. Hypostome. As in the male.

#### Remarks

This species appears restricted to the northern hill areas and has not been collected below 4,000 ft. elevation.

As the specimens collected in West Pakistan were in poor condition, the illustrations used here were copied from Hoogstraal and Varma (1962).

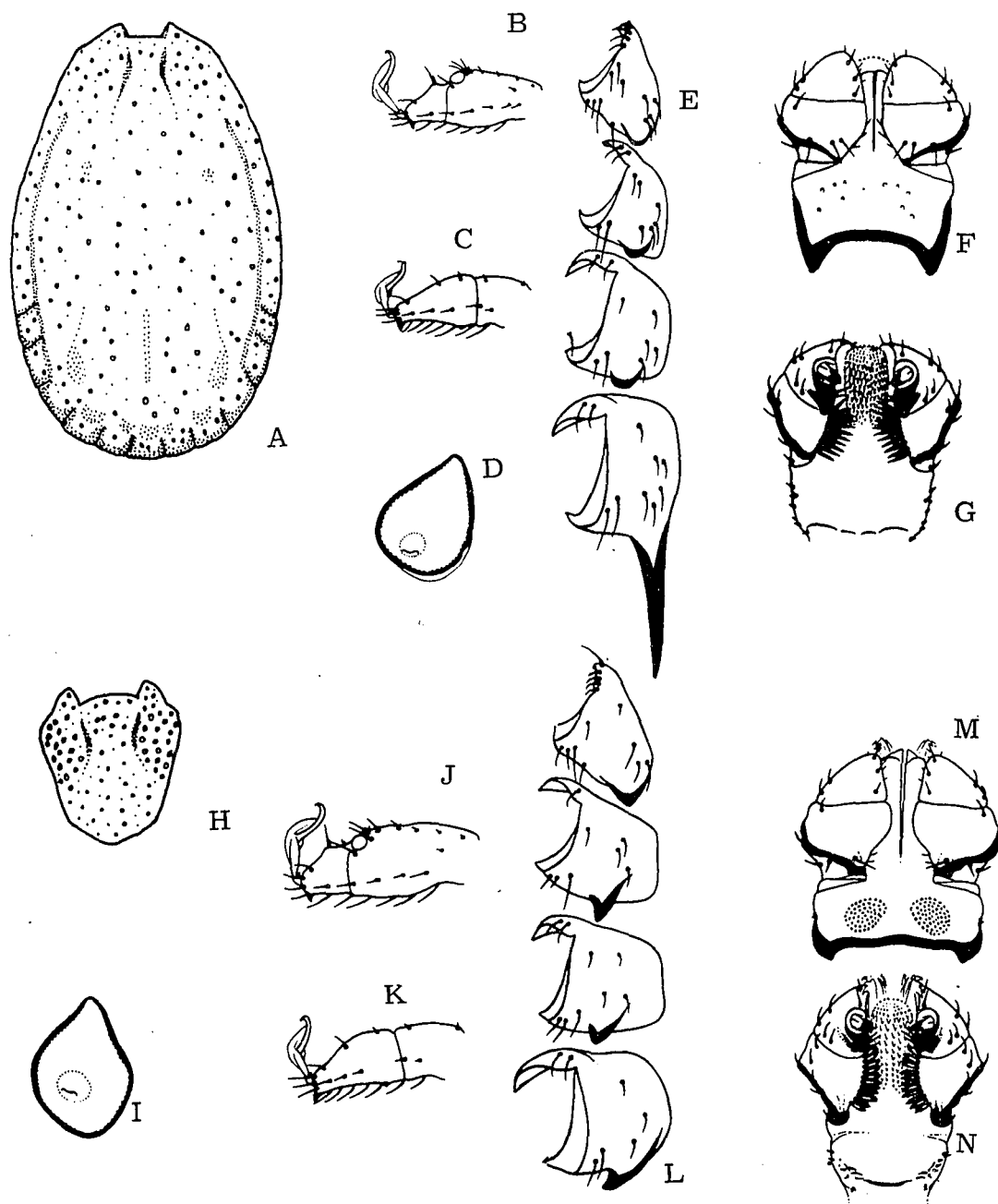
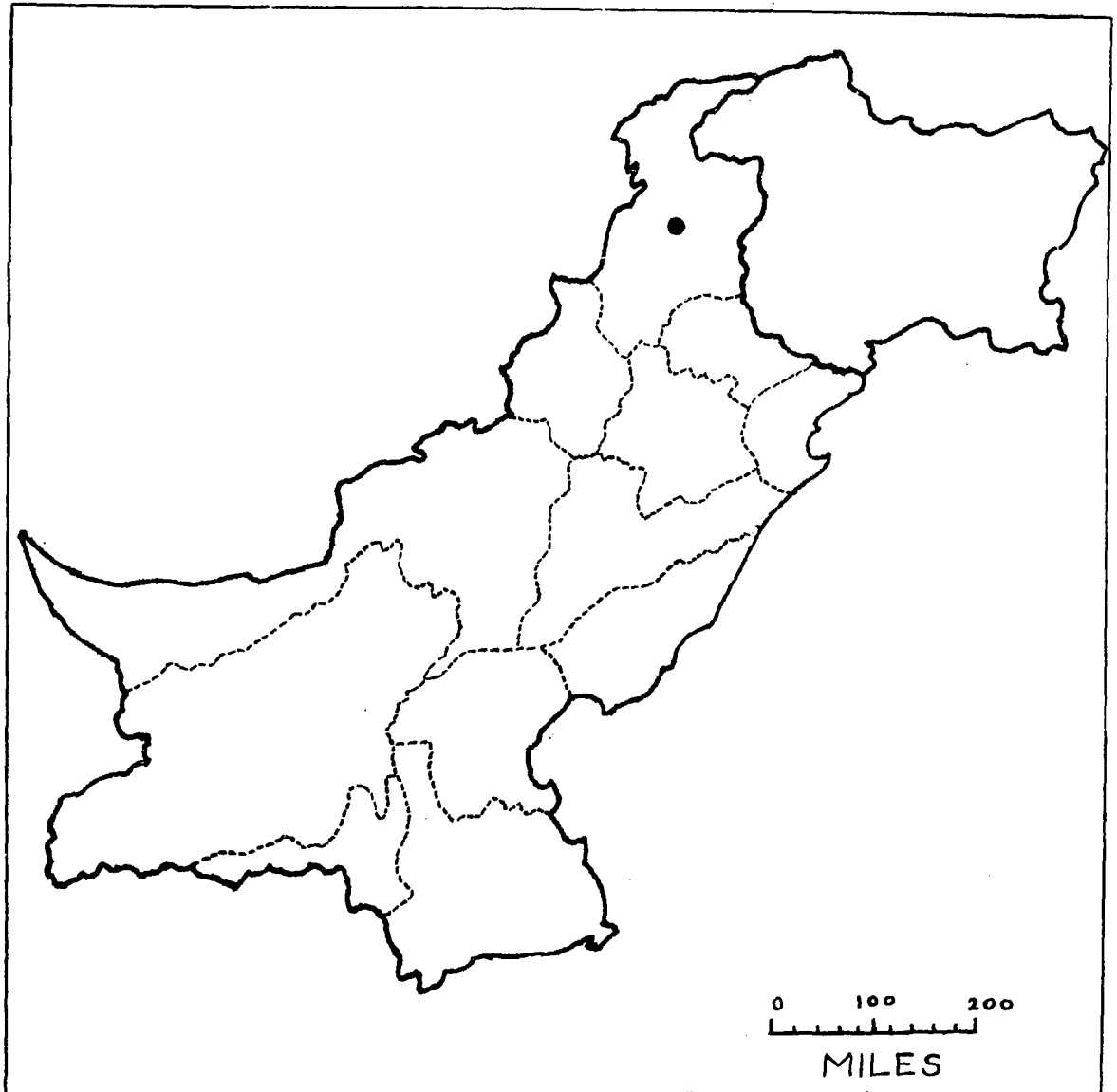


Fig. 7. *Haemaphysalis cornupunctata* Hoogstraal and Varma, 1962.  
 A-G, male: A-scutum; B-tarsus I; C-tarsus IV;  
 D-spiracular plate; E-coxae I-IV; F-capitulum, dorsal  
 view; G-capitulum, ventral view. H-N, female:  
 H-scutum; I-spiracular plate; J-tarsus I; K-tarsus IV;  
 L-coxae I-IV; M-capitulum, dorsal view; N-capitulum,  
 ventral view.



Map IX. Haemaphysalis cornupunctata Hoogstraal and Varma, 1962  
Geographical distribution — West Pakistan

HAEMAPHYSALIS ERINACEI TURANICA POSPELOVA-SHTROM, 1939

Synonymy

Haemaphysalis erinacei

Pavesi, 1884, Ann. Mus. Stor. Nat. Genoa, 20: 483-485.

Feldman-Muhsam, 1951, Bull. Res. Counc. Israel, 1: 96-107

(as a new species).

Feldman-Muhsam, 1953, Bull. Res. Counc. Israel, 2: 372-378

(gives priority to Pavesi).

Hoogstraal, 1955, J. Parasit., 41 (3): 221-233.

Haemaphysalis leachii

Neumann, 1897, Mém. Soc. Zool. France, 10: 349 (material subsequently used as type material for H. numidiana).

Haemaphysalis numidiana

Neumann, 1905, Arch. Parasit. Paris, 9: 230.

Nuttall and Warburton, 1915, Ticks, Pt. 3: 478-479 (as a doubtful species).

Olenev, 1928, Dokl. Akad. Nauk SSSR, (16): 84-96 (in part).

Haemaphysalis numidiana turanica

Pospelova-Shtrom, 1939, Parazit. Sborn. Zool. Inst. Akad. Nauk SSSR, (7): 71-99.

Pospelova-Shtrom, in Pomerantsev, 1946, Opred. Faune SSSR Zool. Muz. Akad. Nauk, Leningrad, (26): 1-28.

Pospelova-Shtrom, in Pomerantsev, 1950, Fauna of the USSR,  
4 (2): 114-115.

Haemaphysalis erinacei turanica

Hoogstraal, 1959, J. Parasit., 45 (2): 227-232.

Hosts, Distribution and Biology

In West Pakistan Haemaphysalis erinacei turanica has been collected in the lower northern foothills and dry western plateau areas. Three collections of adults were made during April and June from hedgehogs (one collection from Hemiechinus megalotis) in Quetta Division and Kalat Division. Five collections of nymphs were from birds, three from Francolinus pondicerianus, and one each from Ammoperdix grisiogularis and Myophonus caeruleus. Nymphal collections were made in March, April, June and July from several areas around Rawalpindi in Rawalpindi Division; Mardan in Peshawar Division; Urrak, Ziarat and Quetta City in Quetta Division; and 77 miles SW of Kalat City in Kalat Division.

Anastos (1957) summarized the following data from several Soviet works. All stages of H. n. turanica (= H. e. turanica) were found on small mammals living in lairs, generally in desert and semi-desert areas. Most adults were collected from April to October but some were taken in November, December and January. Immature stages were collected from September to January but there were records in May-June for nymphs and in July for larvae. The following



hosts were listed: Citellus pygmaeus, Erinaceus rumanicus, Hemiechinus auritus, Rhombomys opimus, Putorius evermanni, Hemiechinus albulus, Paraechinus hypomelas, Vormela sarmatica, Spermophilopsis leptodactylus and cattle. This subspecies has been found in the central Asiatic republics of the Soviet Union and Afghanistan.

#### Disease Relationship

Pomerantsev (1950) considers this species to be a possible vector of Pasturella pestis in rodent populations.

#### Description - Male (Fig. 8, A-G)

1. Body. Light yellow. One specimen, length 3.1 mm, width 1.4 mm.
2. Scutum. Elongate oval. Length 2.7 mm, width 1.4 mm. Cervical grooves short and shallow, limited to anterior fifth of scutum. Lateral grooves long and prominent, extending from anterior third of scutum past first two pairs of festoons. Eleven festoons prominent. Punctations numerous, small to medium sized, uniformly distributed and inconspicuous. Eyes absent.
3. Venter. Genital aperture between coxae II. Spiracular plates subcircular, dorsal projections absent.
4. Legs. Moderate. Coxae I - IV each with a small, bluntly triangular, subequal spur. Pulvilli of tarsi extending less than half the length of the claws.

5. Capitulum. Length 0.5 mm, width 0.7 mm. Basis capituli rectangular, twice as wide as long, dorsal surface concave. Cornua small and triangular, bluntly pointed. Palpi almost as wide as long, strongly salient, article 2 half again larger than article 3. Article 2 dorsally covering article 1, lateral margin strongly flanged, posterior margin convex and without spurs. Dorsally, article 3 bluntly triangular and without spurs. Ventrally, article 2 with seven or more infra-internal setae, posterior margin straight. Article 3 with a moderately long, pointed, ventral spur.

6. Hypostome. Length 0.25 mm. Apex bluntly rounded, dentition 4/4, teeth small.

#### Description - Female (Fig. 8, H-N)

1. Body. Yellow. One specimen, length 6.0 mm (engorged), width 3.1 mm (engorged).

2. Scutum. Oval, widest at midregion. Length 1.3 mm, width 1.0 mm. Cervical grooves prominent, extending into posterior third of scutum. Punctations as in the male. Eyes absent.

3. Venter. Genital aperture at level of anterior margins of coxae II. Spiracular plates subcircular, dorsal margins only slightly convex, dorsal projections absent.

4. Legs. As in the male.

5. Capitulum. Length 0.5 mm, width 0.8 mm. Cornua reduced to blunt stubs. Porose depressions of basis capituli narrow, oval. In

other respects similar to the male.

6. Hypostome. As in the male.

#### Remarks

Due in part to its wide and irregular distribution, this species has a long and confused taxonomic history. This work follows the opinion of Hoogstraal (1959) that ". . . H. erinacei (= H. numidiana) consists of three subspecies: H. e. erinacei Pavesi, 1884, in North Africa, H. erinacei taurica Pospelova-Shtrom, 1939, in the Near East including western U.S.S.R., and H. erinacei turanica Pospelova-Shtrom, 1939, in Central Asia."

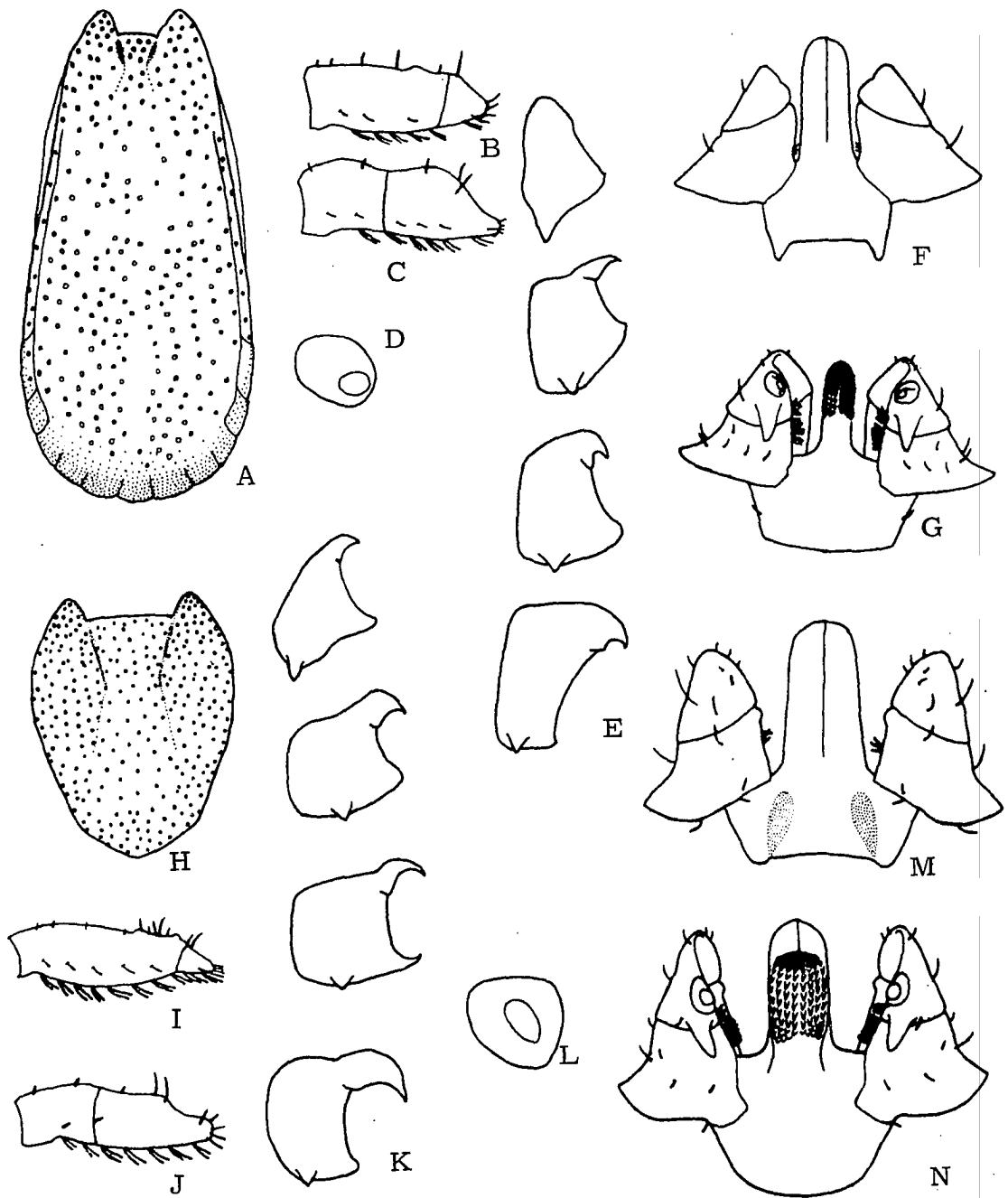
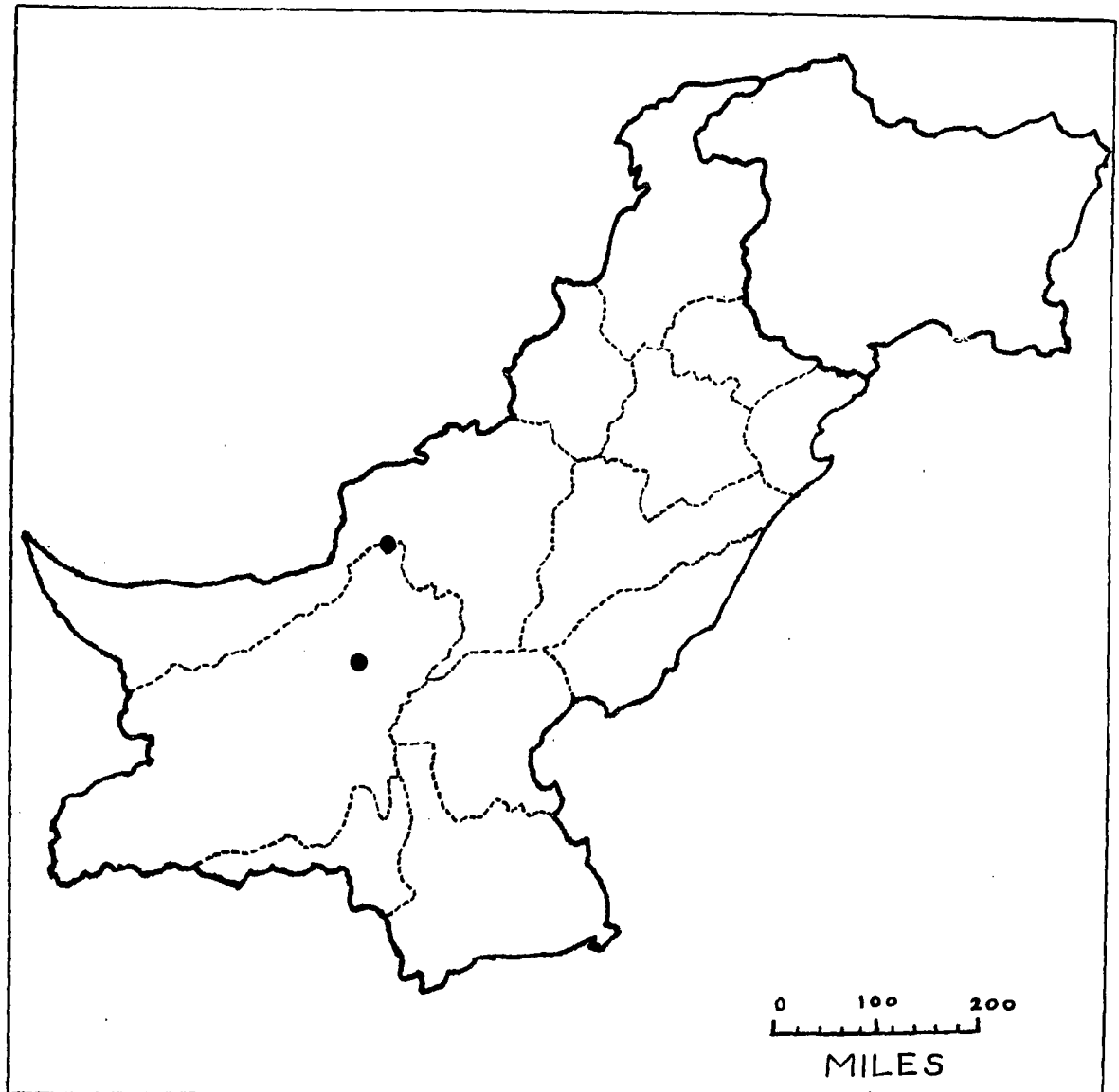


Fig. 8. Haemaphysalis erinacei turanica Pospelova-Shtrom, 1939.  
 A-G, male: A-scutum; B-tarsus I; C-tarsus IV; D-spiracular plate; E-coxae I-IV; F-capitulum, dorsal view; G-capitulum, ventral view. H-N, female: H-scutum; I-tarsus I; J-tarsus IV; K-coxae I-IV; L-spiracular plate; M-capitulum, dorsal view; N-capitulum, ventral view.



Map X. Haemaphysalis erinacei turanica Pospelova-Shtrom, 1939  
Geographical distribution — West Pakistan

HAEMAPHYSALIS HOWLETTI WARBURTON, 1913

Synonymy

Haemaphysalis howletti

Warburton, 1913, Parasitology, 6 (2): 123-124.

Nuttall and Warburton, 1915, Ticks, Pt. 3: 493-494.

Sharif, 1928, Rec. Indian Mus., 30 (3): 240, 241 (key only).

Dhanda, 1964, J. Parasit., 50 (3): 459-465.

Trapido, et al., 1964, Bull. Ent. Res., 55 (2): 267.

Hosts, Distribution and Biology

Only three adult Haemaphysalis howletti have been found in nature. Two were collected from a hill pony near Rawalpindi in 1912, the other from Bandicota sp. near Poona City, India in October, 1962. Nymphs have been collected from Sissi partridge, Centropus sinensis, Myophonus caeruleus, Francolinus francolinus, Francolinus pondicarianus, Rattus rattus rufescens and Mus. sp. Larvae have been collected from Rattus rattus rufescens and Funambulus pennanti.

This species has now been found near Poona City in India, several regions in Rawalpindi Division, Mardan in Peshawar Division and the Urrak Valley in Quetta Division.

The biology of this tick is unknown.

## Disease Relationship

Unknown.

## Description - Male (Fig. 9, A-G)

1. Body. Brown. Three specimens, length 1.7 mm - 2.2 mm, average 2.0 mm; width 1.1 mm - 1.3 mm, average 1.2 mm.
2. Scutum. Ovate, widest slightly posterior to level of coxae IV. Length 1.5 mm - 1.8 mm, average 1.7 mm; width 1.1 mm - 1.3 mm, average 1.2 mm. Cervical grooves moderate, deep and narrow anteriorly, diverging and shallow posteriorly, outer margins somewhat concave; grooves limited to anterior third of scutum. Lateral grooves prominent, beginning at level of coxae III and extending posteriorly past first festoon. Eleven festoons prominent, longer than wide. Punctations medium to large, numerous, distributed randomly. Larger punctations more common in anterior regions. Eyes absent.
3. Venter. Genital aperture between coxae II. Spiracular plates subrectangular with small dorsal projections.
4. Legs. Long and stout. Coxa I with moderate, elongately triangular spur. Coxae II, III with shorter, rounder spurs. Spur of coxa IV slightly longer, narrower than those of II and III.
5. Capitulum. Average length 0.4 mm, average width 0.4 mm; slightly wider than long. Basis capituli dorsally approximately 1.7 times as wide as long (including cornua); lateral margins slightly converging posteriorly, posterior margin between cornua straight or

slightly concave; cornua moderate, triangular, length equals basal width, apex somewhat pointed, lateral margin straight or slightly curved; surface with a few fine punctations. Basis capituli ventrally subrectangular, outer posterior angles rounded; lateral margins with one or two minute setae on each side. Palpal article 1 visible dorsally only as a narrow ridge. Article 2 with nearly half of its breadth salient beyond the lateral margin of basis, salience somewhat flared; basal margin convex, outer margin deeply concave; inner margin with a bulbous projection near anterior end and two to three lanceolate suprainternal setae; ventrally, eight to ten feathery, close set, sometimes overlapping infrainternal setae. Article 2 slightly longer than article 3. Dorsally, posterior margin of article 3 nearly straight, except near the inner end where it curves slightly posteriorly; ventrally, with a narrow, long, blunt spur, directed posteriorly, extending to about half the length of article 2.

6. Hypostome. Stout, club-shaped. Dentition 5/5 to 6/6, teeth small.

#### Description - Female (Fig. 9, H-N)

1. Body. Yellow brown. Three specimens, length (unengorged) 2.3 mm - 2.6 mm, average 2.5 mm; width (unengorged) 1.3 mm - 1.6 mm, average 1.4 mm.

2. Scutum. Subrectangular. Length 0.9 mm - 1.1 mm, average 1.0 mm; width 0.7 mm - 1.0 mm, average 0.9 mm. Lateral margins subparallel anteriorly, somewhat convergent posteriorly; posterior



margin slightly convex. Cervical grooves distinct, deep and narrow anteriorly, shallow and wide posteriorly, outer margins slightly concave, extending into posterior third of scutum. Punctations numerous, large, subequal, distributed all over scutum. Eyes absent.

3. Venter. Genital aperture on level between coxae II and III. Spiracular plates subcircular, dorsal margin fairly straight with slight dorsal projection.

4. Legs. Similar to those of the male, except that coxal spurs II and III are more rounded.

5. Capitulum. Average length 0.5 mm, average width 0.6 mm. Basis capituli dorsally approximately 2.6 times as wide as long (including cornua); lateral margins slightly convex; posterior margin slightly concave; cornua smaller than in the male and rounded posteriorly, half as long as base; porose areas ovoid, separated from each other by a space approximately twice the least diameter of one porose area. Ventrally posterior margin rounded in outline. Palpi longer than in male. Salience on article 2 more flared; inner margin with three lanceolate suprainternal setae; ventrally eight to ten feathery, close set, infra-internal setae. Article 3 with narrower ventral spur than in the male.

6. Hypostome. As in the male.

#### Remarks

This species has been reported from the cooler northern and western regions of West Pakistan. The parasitism of several bird

species by immature stages indicates that the distribution of H. how-  
letti may be spotty and far wider than presently reported.

The material used for illustration was laboratory reared from material collected in Poona City, India, and is part of the collection of Dr. H. Hoogstraal (HH 6136).

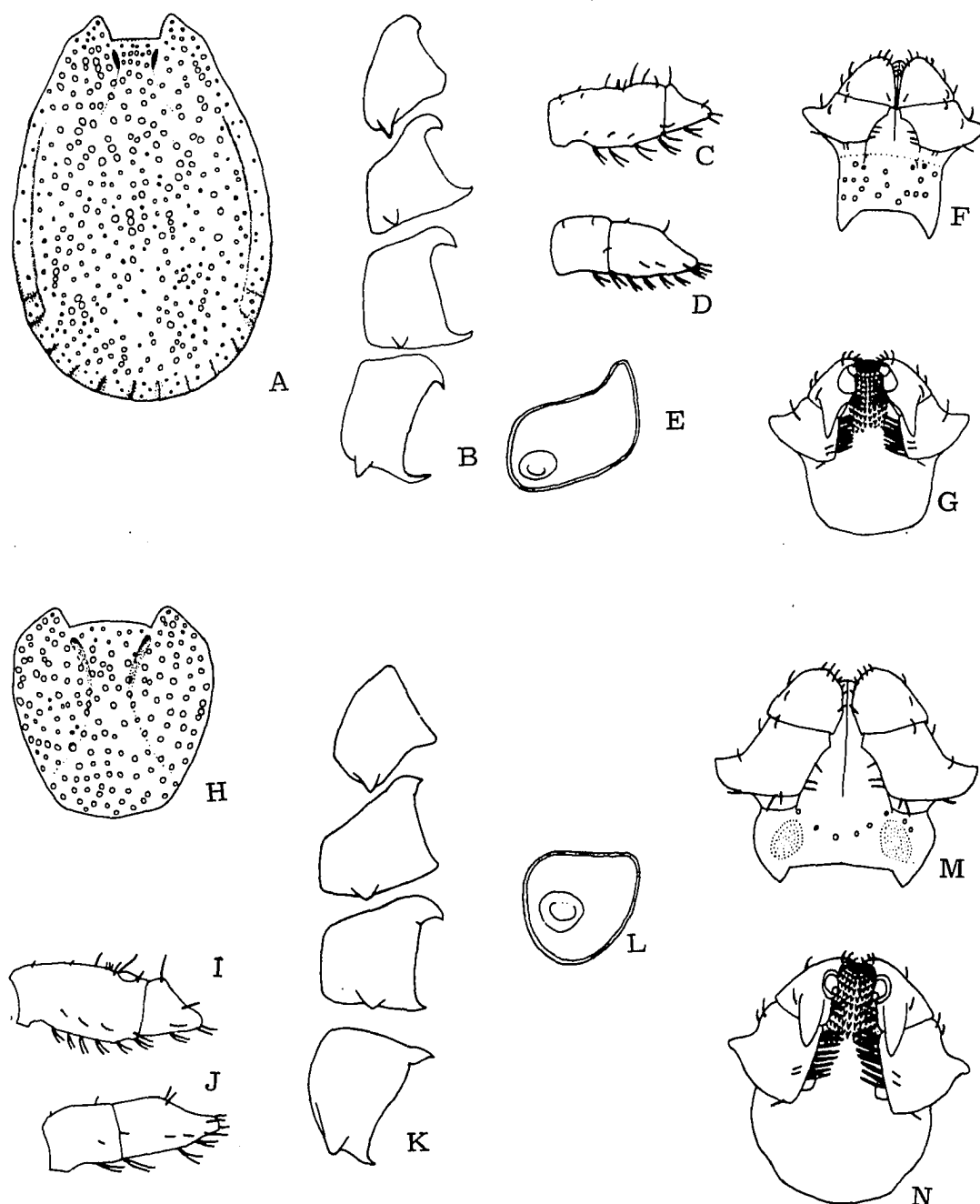
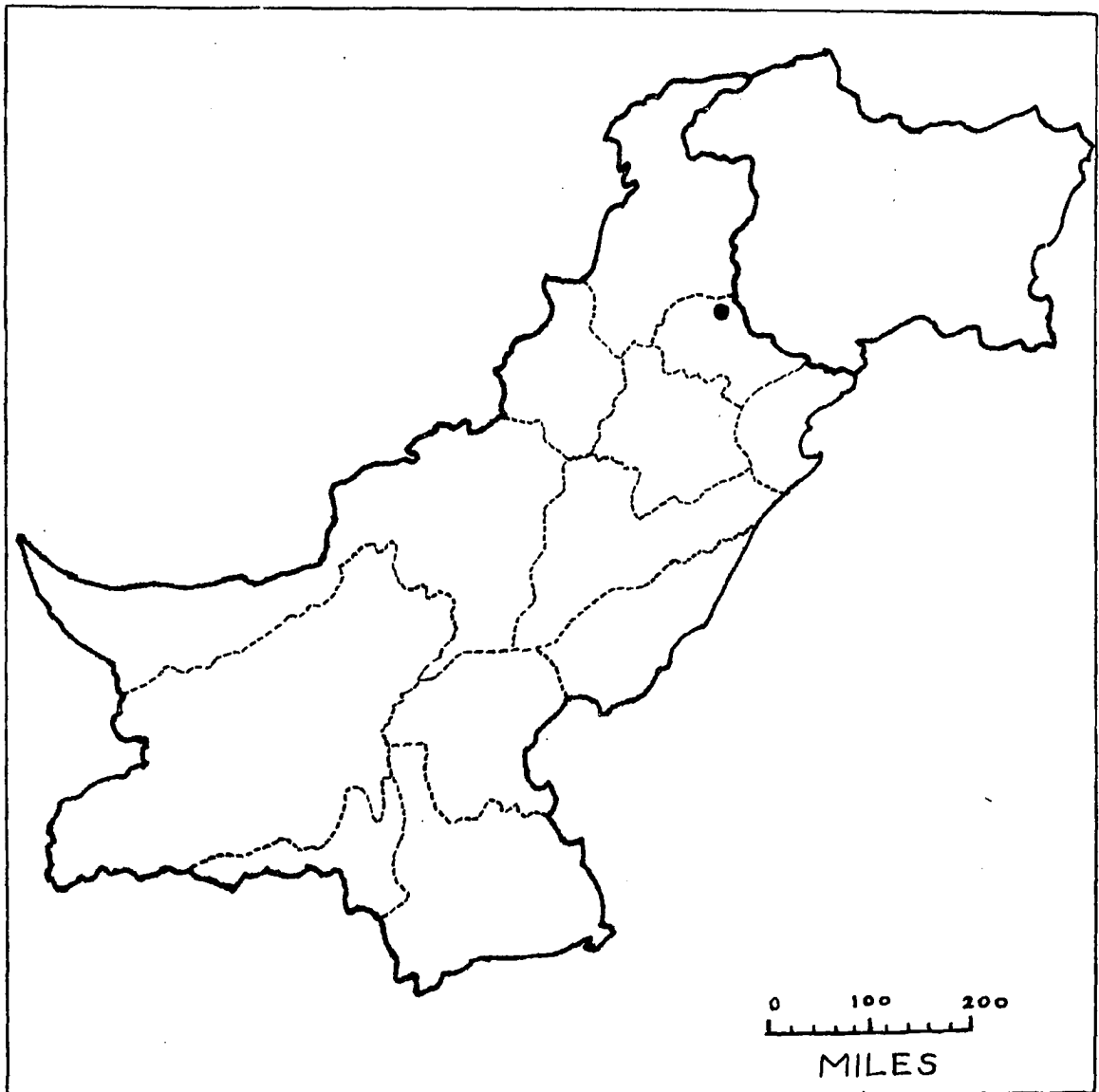


Fig. 9. Haemaphysalis howletti Warburton, 1913. A-G, male: A-scutum; B-coxae I-IV; C-tarsus I, D-tarsus IV; E-spiracular plate; F-capitulum, dorsal view; G-capitulum, ventral view. H-N, female: H-scutum; I-tarsus I; J-tarsus IV; K-coxae I-IV; L-spiracular plate; M-capitulum, dorsal view; N-capitulum, ventral view.



Map XI. Haemaphysalis howletti Warburton, 1913  
Geographical distribution — West Pakistan

HAEMAPHYSALIS INTERMEDIA Warburton and Nuttall, 1909

Synonymy

Haemaphysalis parva

Neumann, 1908, Notes Leyden Mus., 30: 73-91 (preoccupied).

Nuttall and Warburton, 1915, Ticks, Pt. 3: 435-437.

Sharif, 1928, Rec. Indian Mus., 30 (3): 259-260.

Haemaphysalis bispinosa var. intermedia

Warburton and Nuttall, 1909, Parasitology, 2 (1-2): 69-70 (in part).

Nuttall and Warburton, 1915, Ticks, Pt. 3: 433-435 (in part).

Haemaphysalis intermedia

Trapido and Hoogstraal, 1963, J. Parasit., 49 (4): 691-692 (new combination).

Hoogstraal and Trapido, 1963, J. Parasit., 49 (5): 838-846.

Trapido, et al., 1964, Bull. Ent. Res., 55 (2): 249-270.

Hosts, Distribution and Biology

Hoogstraal and Trapido (1963b) found H. intermedia to be common on domestic sheep and goats in southern India. It has also been reported from cattle, chickens and Gallus layfayetti.

In West Pakistan one female was collected in November, 1963, from Francolinus pondicerianus near Tatta, Hyderabad Division.

Elsewhere this species has been reported from India and Ceylon.

#### Disease Relationship

Unknown.

#### Description - Male (Fig. 10, A-G)

1. Body. Yellowish to yellowish brown. Three specimens, length 1.1 mm - 1.5 mm, average 1.3 mm; width 0.5 mm - 0.9 mm, average 0.6 mm.
2. Scutum. Broadly oval, widest at level of coxae IV. Average length 0.9 mm, average width 0.6 mm. Cervical grooves formed by moderate pits and shallow, indistinct grooves. Lateral grooves of medium length, extending to level of coxae III and not enclosing festoons. Eleven festoons long and clearly separated. Punctations numerous, moderate to large in size, shallow to deep, closely spaced to confluent. Eyes absent.
3. Venter. Genital aperture between coxae II. Spiracular plates subcircular to irregularly pentagonal or quadrangular.
4. Legs. Robust. Coxa I with long spinelike spur. Coxae II - IV each with a short broadly triangular spur; that on III largest, II intermediate, IV smallest.
5. Capitulum. Basis capituli rectangular, length (including cornua)  $\frac{2}{3}$  as great as width, lateral margins and posterior margin between cornua straight; cornua moderately large, sharply tapered,  $\frac{2}{3}$  as long as base of basis capituli; surface with a few small punctations. Ventrally bearing approximately six small lateral setae on each side

and a pair of short posthypostomal bristles. Palpi of conical type lacking basolateral salience. Basal margins dorsally and ventrally very slightly convex (almost straight). Lateral margins dorsally very slightly converging in straight line from obtuse basolateral juncture to gradually (or bluntly) rounded apex; ventrally basolateral juncture forms a small point and basal part of article 3 is slightly wider than apical part of article 2. Inner margin of article 3 dorsally widely convex and extended to form inner margin of basal spur of this article; inner margin of article 2 straight or very slightly convex. Article 3 very slightly longer than article 2; outer half of basal margin straight, inner half of basal margin forming a short, sharply pointed, triangular spur (the widely convex inner margin and the internal situation of the dorsobasal spur, as well as the large ventral spur of this article characterize this species). Article 3 ventrally with a heavy gradually tapered spur extending to basal margin of article 2. Setae on inner surfaces of article 2 numbering one or two short and one longer dorsally ("suprainternal setae") and approximately seven closely set lanceolate ventrally ("infrainternal setae"); dorsal and ventral setae of each article numbering approximately four; two setae on inner surface of article 3 ventrally.

6. Hypostome. Small, bluntly rounded. Dentition 4/4, teeth small.

#### Description - Female (Fig. 10, H-N)

1. Body. Yellowish brown. Two specimens, average length

(unengorged) approximately 1.5 mm.

2. Scutum. Length 0.8 mm, width 0.8 mm. Subcircular, widest in anterior half; anterior margins broadly rounded, posterolateral margins more abruptly rounded to give narrower posterior region.

Cervical grooves distinct, convex and extending to midregions of scutum. Punctations moderately numerous, discreet; mostly small and medium size, a few large. Punctations noncontiguous. Eyes absent.

3. Venter. Genital aperture between coxae II. Spiracular plate ovate.

4. Legs. Similar to those of the male.

5. Capitulum. Basis capituli half as long (including cornua) as wide; cornua widely triangular, short, approximately  $1/3$  as long as base of basis capituli; porose areas fairly large, shallow, appear to be partially confluent in some specimens. Palpi similar to those of male; ventral spur of article 3 does not quite reach basal margin of article 2.

6. Hypostome. Similar to that of the male but more elongate. Dentition 4/4, teeth small.

#### Remarks

As only one specimen of H. intermedia was collected in West Pakistan, the material used for illustration in this work was obtained from Dr. Harry Hoogstraal. These laboratory reared specimens were the progeny of a female collected from a goat in Aundh, Poona, India. The Pakistani specimen closely resembled the females in this group, save



that the dorsal spurs of palpal article 3 were reduced.

The description of this species follows that of Hoogstraal and Trapido (1963b).

The name H. intermedia was proposed by Trapido and Hoogstraal (1963) to replace H. parva, which was found to be preoccupied. Thus some of the material formerly identified as H. bispinosa variety intermedia and H. parva has been combined. In the process of selecting a lectotype for this species, several misidentifications were corrected. Nuttall's collection of the two former groupings yielded Haemaphysalis kutchensis Hoogstraal and Trapido, Haemaphysalis paraturturis Hoogstraal, Trapido and Rebello, and Haemaphysalis bispinosa Neumann. Material identified by Sharif (1928) as H. b. intermedia was found to be H. paraturturis.

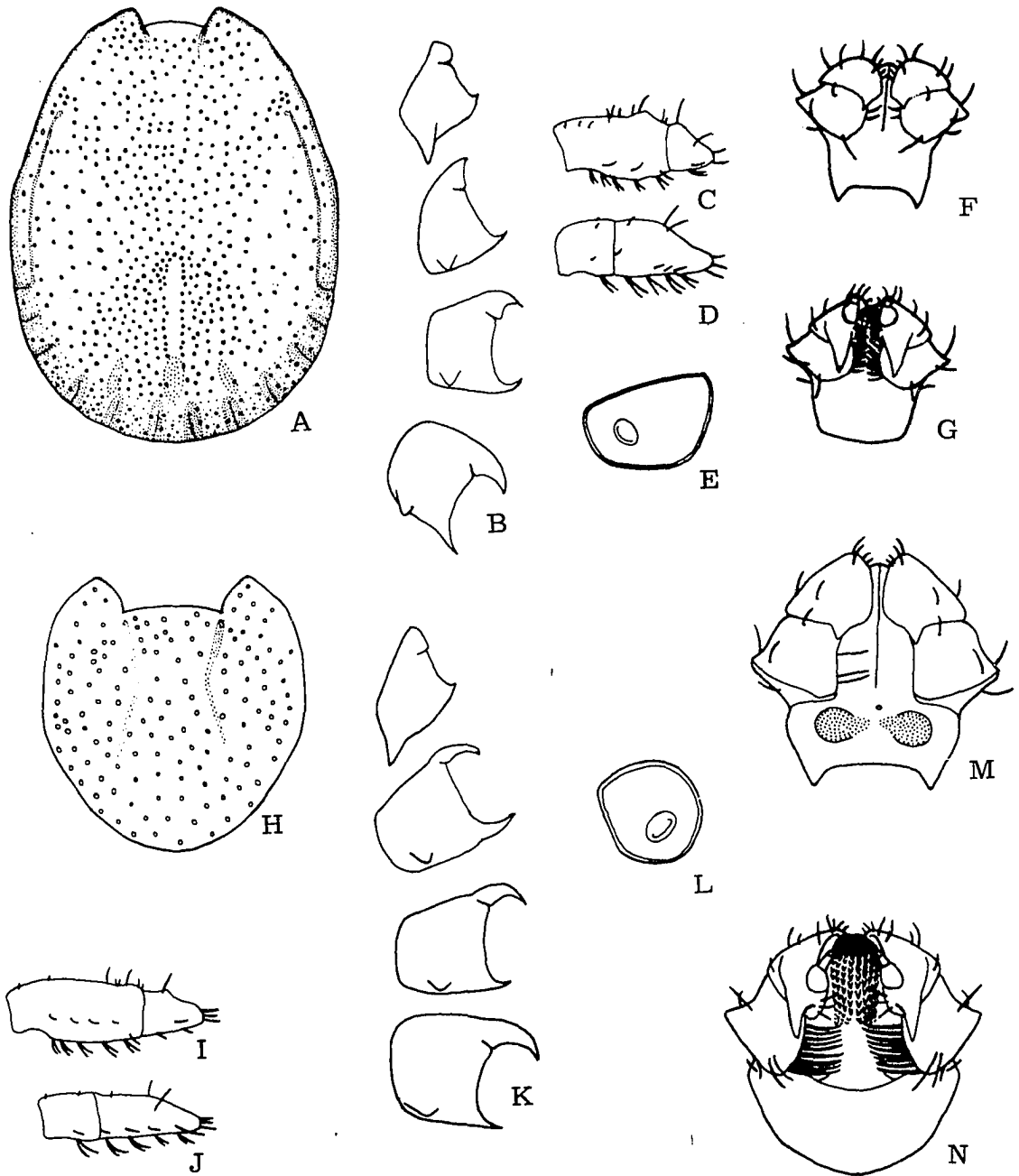
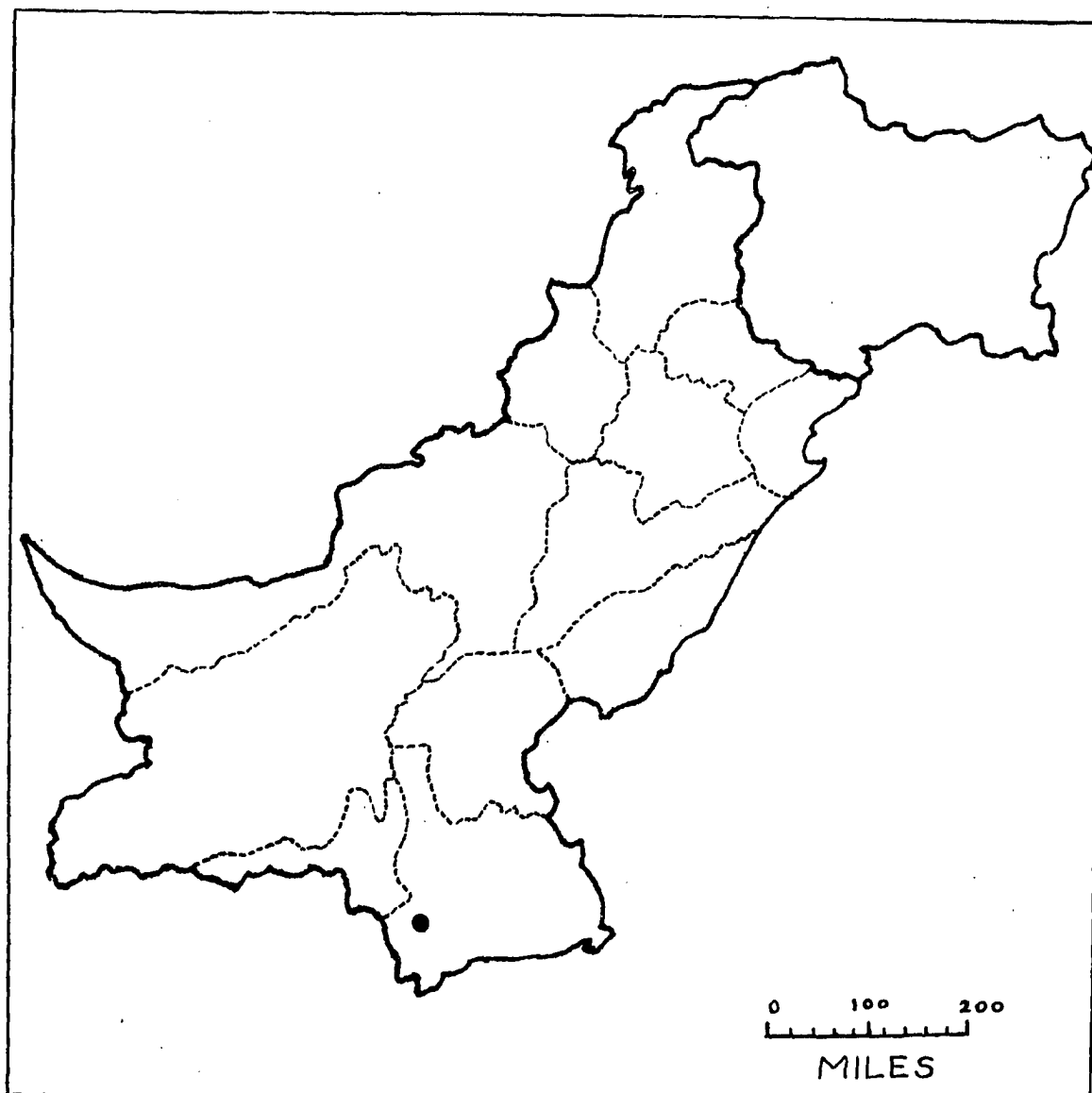


Fig. 10. Haemaphysalis intermedia Warburton and Nuttall, 1909.  
 A-G, male: A-scutum; B-coxae I-IV; C-tarsus I; D-tarsus IV; E-spiracular plate; F-capitulum, dorsal view; G-capitulum, ventral view. H-N, female: H-scutum; I-tarsus I; J-tarsus IV; K-coxae I-IV; L-spiracular plate; M-capitulum, dorsal view; N-capitulum, ventral view.



Map XII. Haemaphysalis intermedia Warburton and Nuttall, 1909  
Geographical distribution — West Pakistan

HAEMAPHYSALIS KASHMIRENSIS HOOGSTRAAL and VARMA, 1962

Synonymy

Haemaphysalis kashmirensis

Hoogstraal and Varma, 1962, J. Parasit., 48 (2): 185-194.

Hoogstraal and McCarthy, 1965, J. Parasit., 51 (4): 674-679.

Hosts, Distribution and Biology

H. kashmirensis has been reported from the western Himalayas at altitudes from 5,000 to 10,000 ft. As collections in these regions were limited to April-October, nothing is known of the winter activity of this tick. This species has been found throughout the valleys of Kagan and Swat, and appears to follow a two or three host cycle. From May through September both larvae and nymphs are commonly found on Agama tuberculata, a lizard which inhabits the rock crevices of stone field fences and rock piles at the river's edge. During the same season adults have been collected from domestic sheep and goats browsing in the fields, and from those of nomadic tribesmen by the river's edge. No other adult hosts are known. Nymphs however, have also been recovered from Petaurista petaurista, Mus musculus, Rattus rattoides and from the debris in a wild animal den (reportedly last occupied by a bear).

In addition to numerous collections in Kagan, Peshawar Division and Swat State, H. kashmirensis was also collected from Zaban and

Kulu in Kashmir.

### Disease Relationship

Unknown.

### Description - Male (Fig. 11, A—G)

1. Body. Reddish brown. Four specimens, length 3.2 mm - 3.6 mm, average 3.4 mm, width 1.8 mm - 2.0 mm, average 1.9 mm.

2. Scutum. Elongate oval, widest at level of spiracular plates. Length 2.7 mm - 3.1 mm, average 3.0 mm; width 1.8 mm - 2.0 mm, average 1.9 mm. Lateral margins converging anteriorly to form short, broad scapulae; posterior margin bluntly rounded. Cervical grooves moderately deep, very short. Lateral grooves deep, long, distinct, extending from level of coxae II to posterior margin of first festoon. Festoons approximately 11 (first pair frequently indistinct). Punctations small, few in number, shallow and indistinct.

3. Venter. Genital aperture between coxae II. Spiracular plates subcircular, dorsal margin relatively straight. Dorsal projection short, wide at base.

4. Legs. Moderately long and robust. Coxal spurs recurved, strong, fairly wide, moderately long, subequal in length and width, arising from apex (I) or approximate to internoposterior corner (II to IV); each spur reaching (I) or slightly overlapping anterior margin of subsequent coxa (II and III).

5. Capitulum. Average length 0.6 mm, average width 0.5 mm. Basis capituli rectangular, lateral margins subparallel, very slightly expanded at level of base of cornua and thence slightly converging as they form cornua; posterior margin between cornua straight; length (including cornua) slightly greater than width; surface with a few scattered punctations; cornua robust, elongately triangular, almost as long as base, apices fairly sharply pointed. Palpi with conical outline. Dorsally article 1 visible as a narrow base; articles 2 and 3 subequal in length. Article 2 with a spur-like ridge on basolateral margin. Ventrally, article 3 with a large, wide, gradually tapering, retrograde spur extending posteriorly at least to midlength of article 2; article 1 visible as a narrow, bulbous base.

6. Hypostome. Average length 0.25 mm. Short, stout, with pointed apex. Dentition 6/6, teeth small.

#### Description - Female (Fig. 11, H-N)

1. Body. Reddish brown to greyish brown. Three specimens, length 3.8 mm (unengorged) - 7.4 mm (engorged), width 2.1 mm (unengorged) - 3.8 mm (engorged).

2. Scutum. Shield-shape. Average length 1.35 mm, average width 1.20 mm. All margins gradually rounded. Cervical grooves moderately deep, slightly concave and extending into posterior half of scutum. Punctations as in the male but more numerous.

3. Venter. Genital aperture between posterior margins of coxae

III. Spiracular plates circular, with short, widely triangular dorsal projections.

4. Legs. As in the male.

5. Capitulum. Average length 0.70 mm, average width 0.64 mm. Generally similar to that of the male, but with reduced ventral spur on palpal article 3. Basis capituli with short, widely triangular cornua; porose areas shallow, of moderate size, tending to be elongately triangular; separated from each other by a distance equaling the width of one area.

6. Hypostome. Average length 0.40 mm. Similar to that of the male but with 5/5 dentition.

#### Remarks

Immature stages of H. kashmirensis may quickly be separated from those of other haemaphysalids by their nymphal (4/4) and larval (3/3) dentition. All other known immature haemaphysalids have 2/2 formulae.

H. kashmirensis is closely related to Haemaphysalis sulcata Canestrini and Fanzago, 1878, which is also found in West Pakistan; however adults of these species are easily separated by the shape of their coxal spurs, etc.

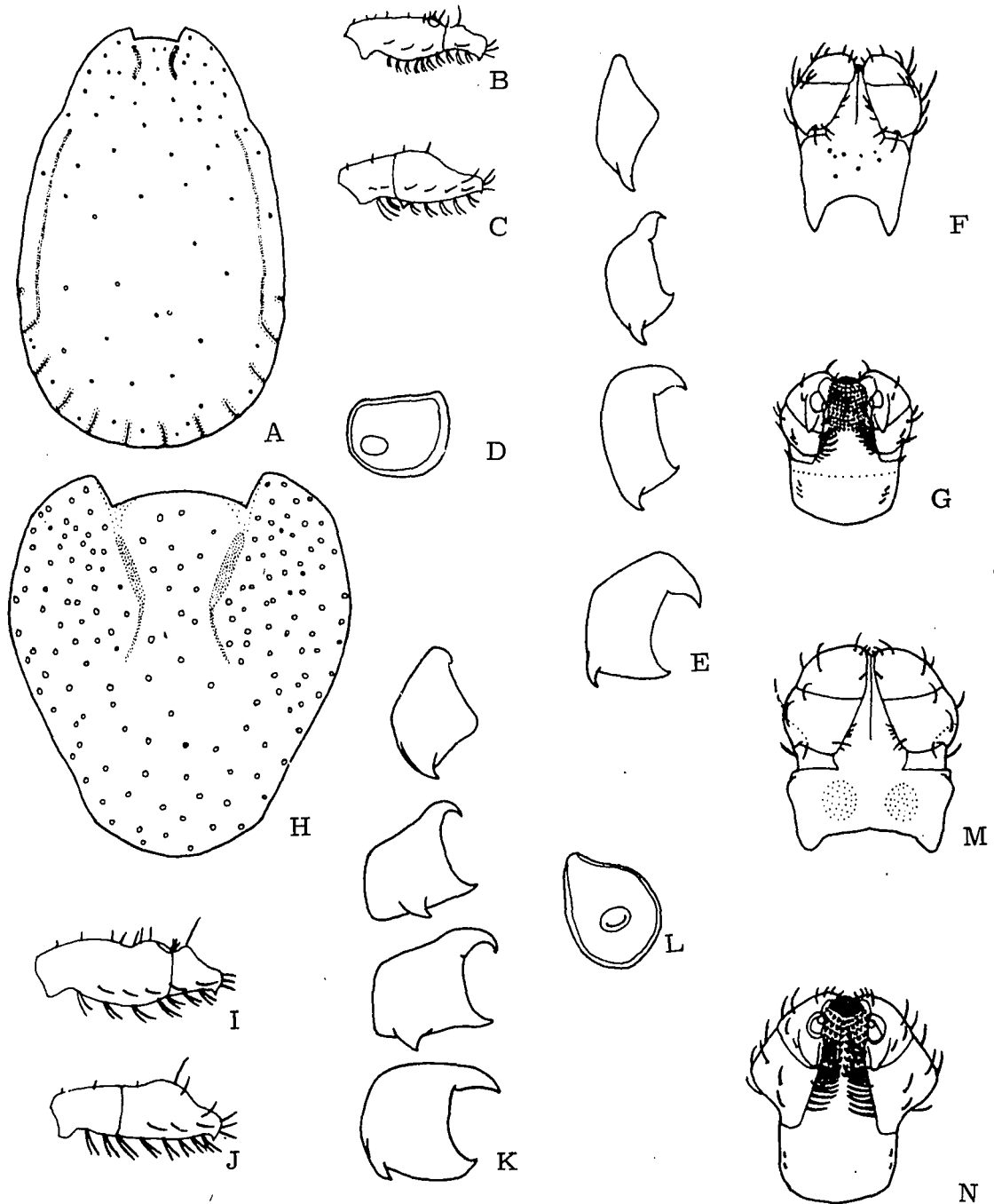
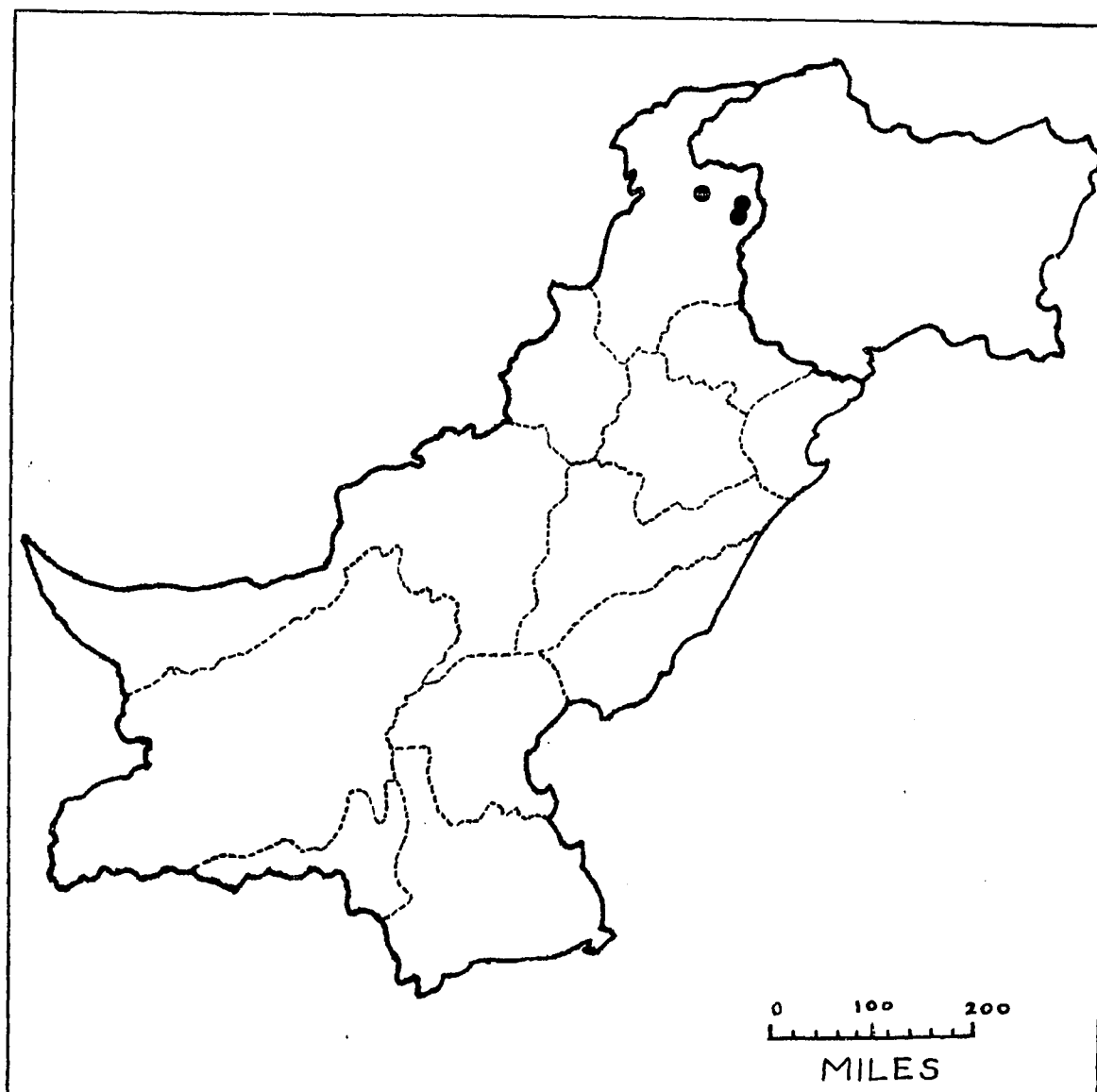


Fig. 11. Haemaphysalis kashmirensis Hoogstraal and Varma, 1962.  
 A-G, male: A-scutum; B-tarsus I; C-tarsus IV;  
 D-spiracular plate; E-coxae I-IV; F-capitulum, dorsal  
 view; G-capitulum, ventral view. H-N, female:  
 H-scutum; I-tarsus I; J-tarsus IV; K-coxae I-IV;  
 L-spiracular plate; M-capitulum, dorsal view;  
 N-capitulum, ventral view.





Map XIII. Haemaphysalis kashmirensis Hoogstraal and Varma, 1962  
Geographical distribution — West Pakistan

HAEMAPHYSALIS KUTCHENSIS HOOGSTRAAL and TRAPIDO, 1963

Synonymy

Haemaphysalis bispinosa var. intermedia

Nuttall and Warburton, 1915, Ticks, Pt. 3: 433-435 (Fig. 363 of male represents H. kutchensis).

Sharif, 1928, Rec. Indian Mus., 30 (3): 258-259 (cites male Fig. 363 of Nuttall and Warburton).

Haemaphysalis kutchensis

Hoogstraal and Trapido, 1963, J. Parasit., 49 (3): 489-497.

Trapido, et al., 1964, Bull. Ent. Res., 55 (2): 267.

Hosts, Distribution and Biology

Eight collections of Haemaphysalis kutchensis were made in West Pakistan. Seven collections of adults came from Lepus nigricollis, one collection of both nymphs and adults came from Centropus sinensis.

In India, H. kutchensis adults have been collected from domestic sheep, domestic dogs, Canis aureus aureus, Felis chaus, Lepus nigricollis dayanus, Francolinus pictus, Francolinus pondicerianus, Pavo cristatus and Centropus sinensis parroti during the months of March, May, August, September and October. Collections were made in the states of Gujarat, Maharashtra and Rajasthan. Nymphs were collected

from Mirafa erythroptera, Saxicoloides fulicata, Turdoides caudatus caudatus, Silvia communis, Passer domesticus indicus and Pastor roseus in the Kutch area of Gujarat State during March, August and September.

Collections in West Pakistan came from the following regions: Lahore area in Lahore Division, Tatta in Hyderabad Division, Nawabshah in Khairpur Division and Kalabagh in Sargodha Division. Collection took place during March, May, June, August, September, November and December.

#### Disease Relationship

Unknown.

#### Description - Male (Fig. 12, A-G)

1. Body. Yellowish brown. Seven specimens, length 1.6 mm - 1.9 mm, average 1.8 mm; width 1.0 mm - 1.2 mm, average 1.1 mm.
2. Scutum. Pyriform. Length 1.4 mm - 1.7 mm, average 1.6 mm; width 1.0 mm - 1.2 mm, average 1.1 mm. Outline widest at level of spiracular plates; abruptly narrower anteriorly from level of coxae III; anterior indentation deep; posterior margin bluntly rounded. Cervical grooves short, moderate, concave. Lateral grooves deep, distinct, extending anteriorly to level of coxae III, posteriorly enclosing first pair of festoons. Festoons distinct, numbering eleven. Punctations small to medium sized, shallow but distinct, numerous but less

common in central area. Eyes absent.

3. Venter. Genital aperture between coxae II. Ventral surface punctate, with small setae. Spiracular plates tear-shaped, dorsal projections moderately long.

4. Legs. Moderately long and stout. Coxae I - IV each with a pointed triangular spur; those of I and IV narrower than those of II and III. Spur of coxa I longer than others.

5. Capitulum. Average length 0.35 mm; average width 0.35 mm. Basis capituli dorsally approximately 1.4 as wide as long (including cornua); surface with a few weak punctations; lateral margins straight, parallel; posterior margin very slightly concave, laterally curving to form internal margins of cornua, which are narrowly pointed apically and approximately  $1/4$  as long as base (lateral margins of cornua may be straight, as illustrated, or very slightly curving to form more tapered cornua than illustrated). Basis capituli ventrally with lateral and posterior margins straight, basolateral juncture rounded. Palpi triangular in outline; article 1 visible dorsally as only a narrow basal ridge; basolateral juncture of article 2 in a plane with basal margin of trochanter I and with only a minute suggestion of lateral salience. Basal margin slightly convex and at a right angle from inner to lateral margins; lateral margin slightly convex, distinctly broken at suture dividing articles 2 and 3 by slight elongation of basal margin of article 3. Article 2 (measured in a straight line from base of article 2 to apex of article 3) not quite equaling article 3 in length.

Article 3 with inner margin convex and recurved at basal juncture; basal margin straight, much longer than distal margin of article 2 (this is a conspicuous feature of this species). Article 2 with inner margin straight or somewhat concave and overhung by elongate basal margin of article 3. Setae on dorsal surface numbering six on article 2 and five on article 3. Palpi ventrally with lateral and basal margins essentially similar to those of dorsal surface; article 3 with a heavy, elongately triangular spur extending at least to midlength of article 2; setae numbering seven on article 3; inner margin of article 2 with seven or eight closely spaced lanceolate setae ("infrainternal setae").

6. Hypostome. Short, blunt, average length 0.2 mm. Dentition 4/4, teeth small.

#### Description - Female (Fig. 12, H-N)

1. Body. Dark brown. Four specimens, length 2.2 mm (unengorged) - 4.6 mm (engorged), width 1.3 mm (unengorged) - 2.8 mm (engorged).

2. Scutum. Shield-like. Average length 0.8 mm, average width 0.8 mm, slightly longer than wide. Lateral margins mildly convex on anterior 2/3, more abruptly narrowing posteriorly in unengorged specimens but less so in engorged specimens; posterior margin broadly rounded. Cervical grooves shallow and slightly concave, extending into middle third of scutum. Punctations medium to large, randomly distributed. Eyes absent.

3. Venter. Genital aperture between coxae II. Spiracular plates subcircular, dorsal projections greatly reduced.

4. Legs. As in the male except that the spurs of coxae I, IV are wider and coxa IV is reduced.

5. Capitulum. Average length 0.45 mm, average width 0.50 mm. Basis capituli slightly over twice as wide as long; lateral margins slightly indented anteriorly, narrowing in posterior regions. Cornua short and broad. Posterior margin of basis slightly concave. Porose areas of basis small, ovate and separated from each other by a distance over twice the diameter of one porose area. Palpi with basal margin of article 2 not so acutely angled as in the male; thus lateral margins of article 2 are longer than in the male and article 2 and 3 are subequal in length. Inner dorsal margin of article 2 with three or four lanceolate setae. Ventral spur of article 3 as in the male. Inner margin of article 2 with eight or nine lanceolate setae.

6. Hypostome. As in the male.

#### Remarks

In commenting on the variety of birds serving as hosts for the immature stages of H. kutchensis, Hoogstraal and Trapido (1963a) noted that Kutch (the site of collection) was an important flyway of birds migrating between Central Asia and southern India and Ceylon, and that collections took place during the spring and fall migration. The Indus basin also serves as a flyway for migrating birds and dis-

tribution of H. kutchensis in West Pakistan is thus far limited to this area.

The area of Kutch is frequently spelled "Cutch". Here the usage of Hoogstraal and Trapido (1963a) has been followed. Elsewhere in this work the spelling "Cutch" is employed.

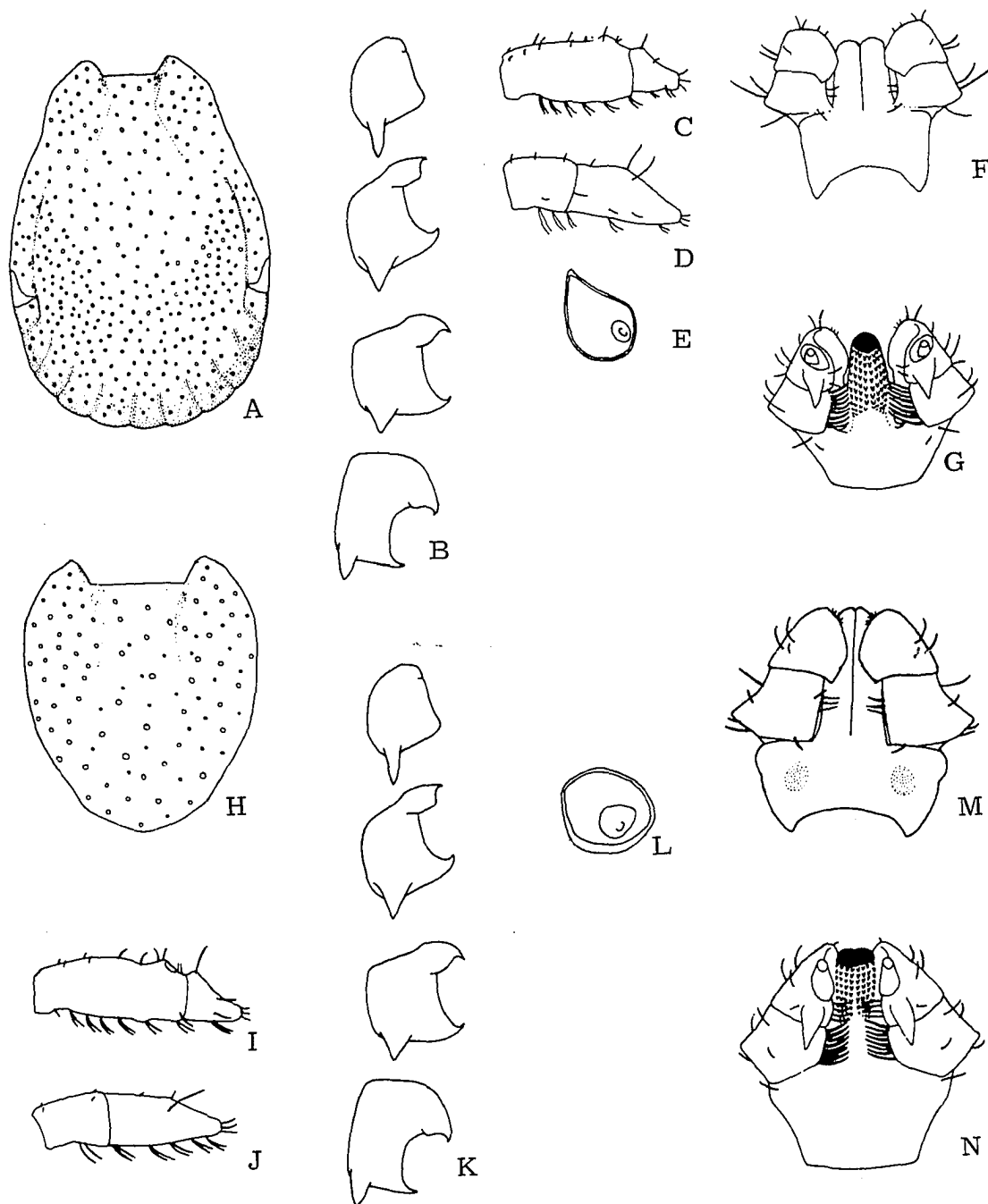
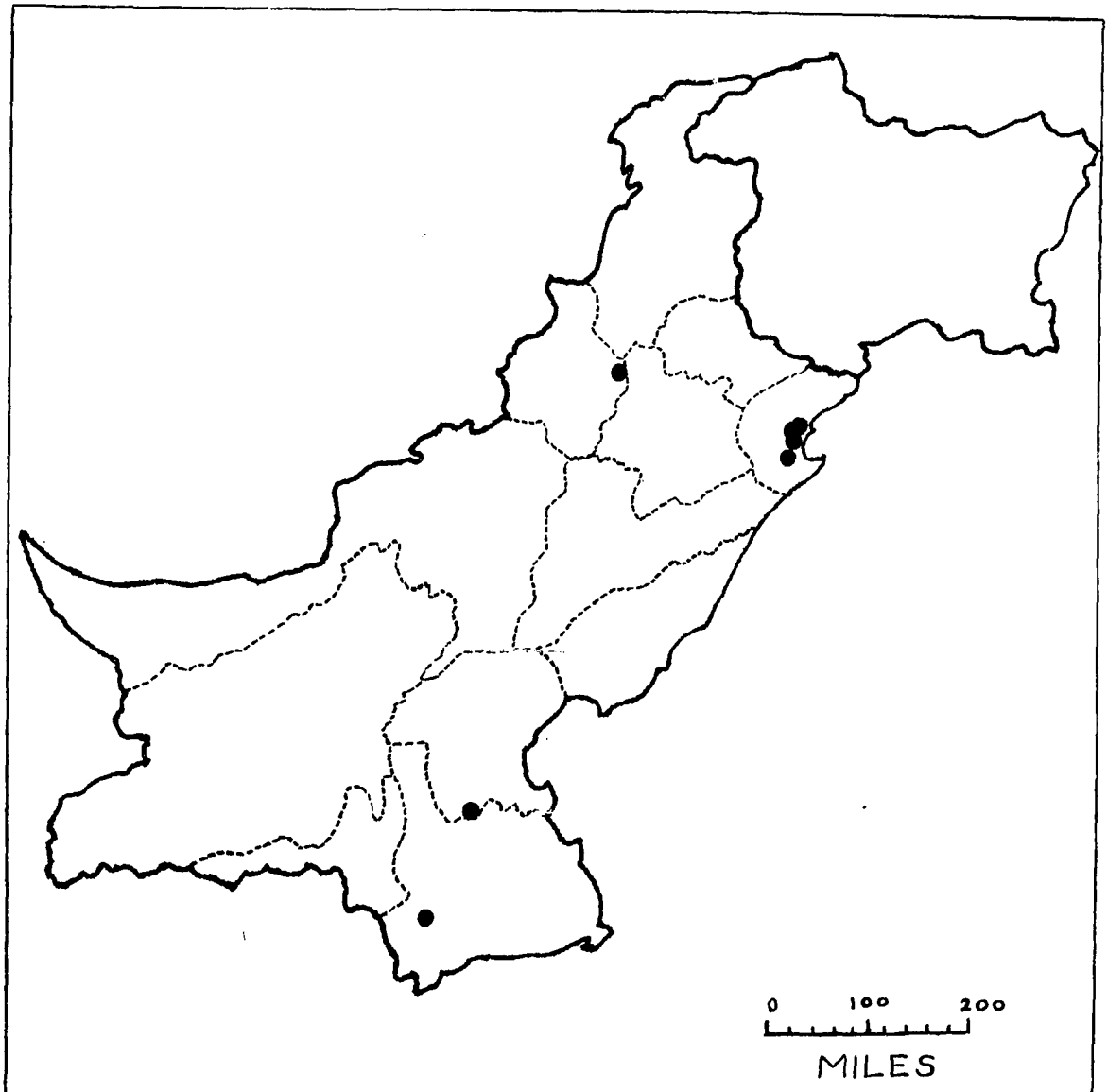


Fig. 12. Haemaphysalis kutchensis Hoogstraal and Trapido, 1963.  
 A-G, male: A-scutum; B-coxae I-IV; C-tarsus I;  
 D-tarsus IV; E-spiracular plate; F-capitulum, dorsal  
 view; G-capitulum, ventral view. H-N, female:  
 H-scutum; I-tarsus I; J-tarsus IV; K-coxae I-IV;  
 L-spiracular plate; M-capitulum, dorsal view;  
 N-capitulum, ventral view.





Map XIV. Haemaphysalis kutchensis Hoogstraal and Trapido, 1963  
Geographical distribution — West Pakistan

HAEMAPHYSALIS LEACHII (AUDOUIN, 1827)

Synonymy

Ixodes leachii

Audouin, 1827, Description de l'Égypte, 2nd. ed., 22, Zool.:  
428 (original descriptions ♂, ♀).

Rhipistoma leachii

Koch, 1844, Arch. Naturgesch., 10 (1): 239 (description).

Rhipistoma ellipticum

Koch, 1844, Arch. Naturgesch., 10 (1): 239 (description).

Rhipicephalus ellipticus

Koch, 1847, Übersicht des Arachnidensystems, IV: 135  
(description).

Rhipidostoma leachii

Karsch, 1878, Monatber. Ak. Wissensch., Berlin: 337  
(description).

Opisthodon asiaticus

Supino, 1897, Atti Soc. Veneto-Trent. di Sci. Nat., 2 ser.,  
III (1): 252 (description ♂ tarsus).

Opisthodon canestrinii

Supino, 1897, Atti Soc. Veneto-Trent. di Sci. Nat., 2 ser.,  
III (1): 252 (description ♂ tarsus).

Opisthodon gestroi

Supino, 1897, Atti Soc. Veneto-Trent. di Sci. Nat., 2 ser.,

III (1): 252 (description♀ tarsus).

Haemaphysalis leachi

Neumann, 1897, Mém. Soc. zool. Fr., 10: 347-350 (description

♂, ♀; distribution, hosts).

Warburton, 1910, Parasitology, 3 (4): 402 (variety indica).

Nuttall and Warburton, 1915, Ticks, Pt. 3: 460-476.

Sharif, 1928, Rec. Indian Mus., 30 (3): 263-267.

Sen, 1938, Indian Jour. Vet. Sci. and Animal Husbandry, 8:

133-147 (Indian distribution).

Haemaphysalis leachii leachii

Neumann, 1911, Das Tierreich, 26: 114.

Hoogstraal, 1956, African Ixodoidea, Vol. I, Ticks of the Sudan:

364-376.

Hoogstraal, 1958, J. Parasit., 44 (5): 548-558 (neotype selection and description).

Elbl and Anastos, 1967 (in press).

Haemaphysalis leachii

Trapido, et al., 1964, Bull. Ent. Res., 55 (2): 249-270.

## Hosts, Distribution and Biology

In West Pakistan adults of Haemaphysalis leachii have been collected from Canis aureus, Herpestes auropunctatus, Herpestes ed-

wardsi and Vulpes bengalensis. This species has not been collected from domestic dogs; however, these animals were only infrequently examined (for a variety of reasons, ranging from ill temper to distemper). Immature stages have been collected from Herpestes auro-punctatus, Herpestes edwardsi, Hemiechinus auritus, Tatera indica, Rattus rattus, Cricetulus sp., Apodemus sp., Mus. sp., Suncus sp., Meriones sp., Alticola sp. and Nesokia sp.

Adult stages have been collected around Lahore in Lahore Division and Charatha, Soomra Lake and Soofi in Hyderabad Division. Immature stages have been collected from the Urrak Valley in Quetta Division; Islamabad in Rawalpindi Division; Parachinar in D. I. Khan Division; Shogran, Naran, Dir and Saidu Sharif in Peshawar Division.

H. leachii has been reported from many regions in Africa and the Middle East; however, it has not been reported from the Soviet Union, Iran, Turkey and Afghanistan. Eastern records of this species (or a closely allied form) include Thailand, Burma, New Zealand (doubtful) and India.

In West Pakistan both adults and immature stages have been found throughout the year, but most frequently in the period May – October. H. leachii has been found under a wide variety of ecological conditions, from the barren plateau regions in Kalat and the Sind Desert, to the well irrigated farmlands of the Lahore area. Its elevational distribution ranges from sea level (in Sind) to above 7,000 ft. (Kagan Valley).

Hoogstraal (1956) has summarized the following from the works of Nuttall (1913), Nuttall and Warburton (1915) and Lounsbury (1901, 1902, 1904):

This tick requires three hosts upon which to feed during its larval, nymphal, and adult stages. About a week after molting each stage readily attaches to the host, which under experimental conditions may be a number of different animals, jackal, dog, ferret, hedgehog, goat, or rabbit. It appears to be immaterial upon which of these hosts the ticks feed. Larvae and nymphs feed for three to seven days (two to three days: Lounsbury), occasionally longer. Females attach for eight to sixteen days. Males may remain upon the host for many weeks. Air temperature, within the limits observed ( $9^{\circ}\text{C}.$  to  $23^{\circ}\text{C}.$ ), appears to exert little or no influence upon the time ticks remain upon the host, the warmth from the animal being doubtless sufficient to keep the ticks active.

The time required for metamorphosis is influenced by temperature. Larvae hatch after 26 to 37 days at  $20^{\circ}\text{C}.$  or after 58 to eighty days at  $12^{\circ}\text{C}.$  to  $13^{\circ}\text{C}.$  Nymphs emerge, as a rule, after thirty to forty days. Adults emerge after fifteen or sixteen days at  $24^{\circ}\text{C}.$  to  $26^{\circ}\text{C}.$ , but require up to seventy days at  $14^{\circ}\text{C}.$

The unfed tick survives for long periods under favorable conditions. In small corked bottles maintained at about  $12^{\circ}\text{C}.$ , larvae are still active after 169 days, nymphs after 52 days, and adults after about 210 days.

Males and females placed simultaneously upon the host scatter but in two or three days both sexes are found attached in close proximity to each other. Copulation occurs upon the host (HH observation). Lounsbury saw marked males detach and reattach close to females. A male may mate with more than one female.

After a replete female abandons the host, the interval before egg-laying commences is markedly influenced by temperature. Females held at  $23^{\circ}\text{C}.$  begin oviposition after three to five days; at  $16^{\circ}\text{C}$  to  $21^{\circ}\text{C}.$  after fourteen to eighteen days; at lower temperatures after 24 to 60 days. Whereas an occasional female dies as soon as oviposition is completed, others may survive for a few

days or, exceptionally, for a month. One tick deposits from 2400 to 4800 eggs.

In nature, the yellow dog-tick may produce two generations a year. Lounsbury reared three generations a year in an incubator. Taking average figures for ticks raised under favorable conditions, the cycle may be completed in 123 days, as follows:

PERIOD	DAYS
Preoviposition	4 (23°C.)
Oviposition to hatching	30 (20°C.)
Larval prefeeding period	7
Larva feeds	5
Premolting period	31 (17°C.)
Nymphal prefeeding period	7
Nymph feeds	5
Premolting period	15 (24°C.)
Adult prefeeding period	7
Adult (female) feeds	<u>12</u>
	123

Hoogstraal (1958) later observed the following in Egyptian populations of H. leachii:

. . . Immature stages of H. l. leachii parasitize chiefly grass-rats, Arvicanthis n. niloticus (Desmarest, 1822) in their nests, and less commonly hedgehogs, Hemiechinus auritus aegyptius (E. Geoffroy St. Hilaire, 1803), in their burrows. Grass-rats are numerous and widely spread in cultivated areas of the Nile Delta and Valley, an ecological situation shared by few other small mammals, e. g. commensal rats and mice, and shrews. Larvae and nymphs, both engorged and unengorged, as well as recently molted, unengorged adults, can be found in grass-rat nests at all times of the year. Adults parasitize the following carnivores: the jungle cat, Felis chaus nilotica de Winton, 1898; the common fox, Vulpes v. aegyptiaca (Sonnini, 1816); and the wolf jackal, Canis aureus lupaster Hemprich and Ehrenberg, 1833. We have not found this tick on domestic dogs or on the common commensal weasel, Mustela nivalis subpalmata Hemprich and Ehrenberg, 1833, in Cairo or in Nile Valley or Delta villages. More extensive search will probably reveal this tick on domestic dogs in areas where foxes, jackals, or

jungle cats forage or where Arvicanthis rats occur. The infested carnivores noted above make their dens at the fringe of cultivation or in the desert within a few miles of cultivation; they forage in the fields and on the desert edge. Carnivores confined to the desert have not been found bearing this tick.

#### Disease Relationship

Hoogstraal (1956) listed H. leachii as a vector of Rickettsia conori, Coxiella burneti and Babesia canis. He also cited experimental evidence that it is an efficient vector of R. rickettsi in the laboratory and lists as questionable reports that this species transmits B. canis to jackals and Nuttallia felis to domestic cats.

#### Description - Male (Fig. 13, A-G) (See "Remarks" first)

1. Body. Light yellow to yellow brown. Twenty-two specimens, length 2.3 mm - 2.5 mm, average 2.4 mm; width 1.0 mm - 1.2 mm, average 1.1 mm. Small form averages 1.8 mm in length, 0.9 mm in width.

2. Scutum. Narrow, elongate oval. Length 2.0 mm - 2.2 mm, average 2.1 mm; width 1.1 mm - 1.3 mm, average 1.2 mm. Cervical grooves shallow and concave, limited to anterior quarter of scutum. Lateral grooves long and distinct, extending from anterior quarter of scutum past the first two pairs of festoons. Punctations medium sized, shallow and numerous, uniformly distributed over scutum; those in anterior third larger and deeper than rest. Eyes absent.

Small form less elongate. Cervical grooves virtually absent. Lateral grooves extending past only first pair of festoons. Punctations small, shallow and very sparse.

3. Venter. Pale yellowish white. Genital aperture between coxae II. Spiracular plates subquadrangular, dorsal projections absent.

4. Legs. Moderate. Each coxa with a short, wide, triangular spur. Coxal setae long, some extending half the length of the coxae. Coxal hairs reduced in small form.

5. Capitulum. Average length 0.35 mm, average width 0.60 mm. Basis capituli quadrangular, twice as wide as long; lateral margins straight, diverging anteriorly; posterior margin straight. Cornua large, sharp and triangular. Palpi widely salient, articles 2 and 3 far wider than long. Outer margin from apex to widest salience straight, curving posteriorly from this point to form large dorsal and ventral spurs medially on the posterior margins of article 2. Inner dorsal margins of article 2 with blunt, toothlike extension. Article 3 triangular and inconspicuous dorsally; ventrally with a long prominent spur extending posteriorly to the level of widest salience of article 2.

Capitulum of small form similar but reduced. Spurs proportionately smaller, cornua greatly reduced with widely triangular shape.

6. Hypostome. Average length 0.20 mm. Dentition 4/4 to 5/5, teeth small.

Average length of small form 0.15 mm.



## Description - Female (Fig. 13, H-N)

1. Body. Yellowish brown. Fourteen specimens, length 2.2 mm (unengorged) - 5.2 mm (engorged), width 1.2 mm (unengorged) - 3.8 mm (engorged).

2. Scutum. Ovate, widest in midregion. Length 0.8 mm - 1.0 mm, average 0.9 mm; width 0.7 mm - 0.8 mm, average 0.8 mm. Posterolateral margins sometimes sinuous. Cervical grooves deep and converging in anterior third of scutum, then diverging as faint depressions into posterior half of scutum. Punctations small to medium sized, shallow and numerous (most numerous in regions between cervical grooves and lateral margins). Eyes absent.

3. Venter. Genital aperture between coxae II. Spiracular plates subcircular, dorsal projections absent.

4. Legs. As in the male.

5. Capitulum. Length 0.40 mm - 0.50 mm, average 0.45 mm; width 0.55 mm - 0.64 mm, average 0.61 mm. Basis capituli quadrangular, lateral margins diverging anteriorly, over twice as wide as long, with short, wide, pointed cornua; porose areas subcircular, prominent and widely separated. Palpi dorsally similar to those of male; ventrally article 2 with wider, less pronounced spur, posterolateral margin only slightly curved; article 3 as in the male.

6. Hypostome. Average length 0.21 mm, otherwise as in the male.

## Remarks

In his paper on African haemaphysalid ticks Hoogstraal (1964) made the following statement: "The leachii group is the most polymorphic of any in this genus and, to date, the more it has been studied, the more confused the taxonomic status of its various components has become." This statement holds true in West Pakistan, where populations of this species show great variations in both size and structure. The same situation obtains in India where Trapido, et al., (1964) noted the presence of two "species" in laboratory reared groups. They concluded that, "a study of variations of all stages from a diversity of hosts and geographical localities will be necessary before the taxa can be assigned specific or subspecific names with any assurance".

Males of H. leachii in West Pakistan usually fall into two groups; a large form found on wolves and jackals, and a small form found on mongooses. Males of the large form range from 2.3 mm to 2.5 mm in length and males of the small form range from 1.7 mm to 1.8 mm. However, in one collection (off Canis aureus) both the large form and an intermediate form (2.0 mm - 2.1 mm in length) were collected. Females at present cannot be grouped.

In 1910 Warburton described Haemaphysalis leachi var. indica from Calcutta (off Canis aureus). In 1928 Sharif redescribed var. indica and noted that the dorsal and ventral spurs on the posterior margin of palpal article 2 were present but reduced, not absent as stated

by Warburton. The Sharif redescription could well apply to the small form of H. leachii found in West Pakistan, but at present there is insufficient evidence to either validate or invalidate this taxon. Therefore H. leachii is treated here as simply a polymorphic species without subspecific categories.

Sharif (1938) reported this species on cattle and goats in pre-partition India, exclusive of the North Western Provinces. Extensive examination of cattle and goats in West Pakistan has failed to reveal the presence of H. leachii on these animals.

The wild host list for H. leachii in West Pakistan is probably far more extensive than that presently reported. Elbl and Anastos (1967) have listed over 100 host species (including birds) for African populations.

The specimens illustrated, measured and described in this work are those of the large form. Where pertinent, variations of the small form are noted in the description.

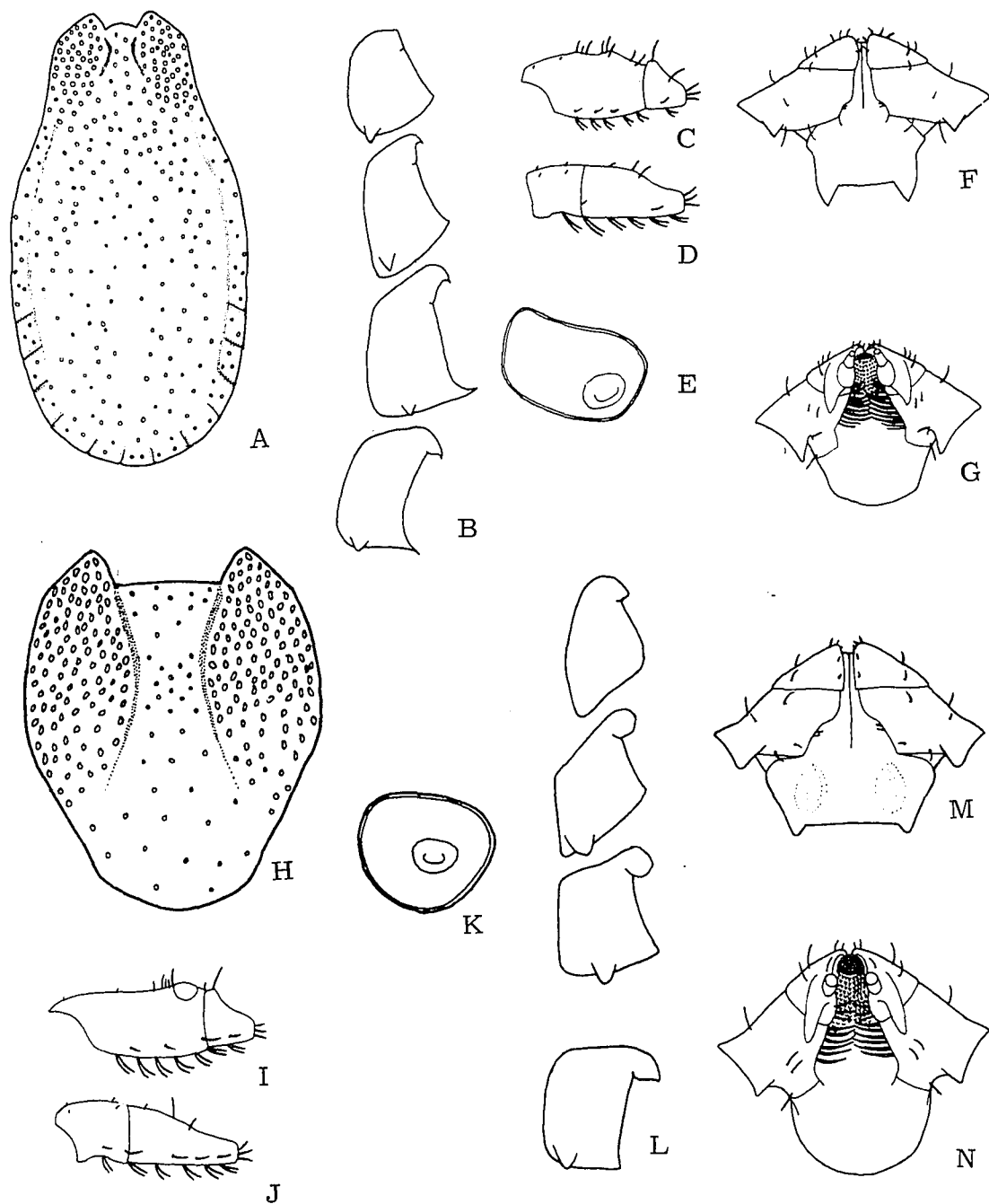
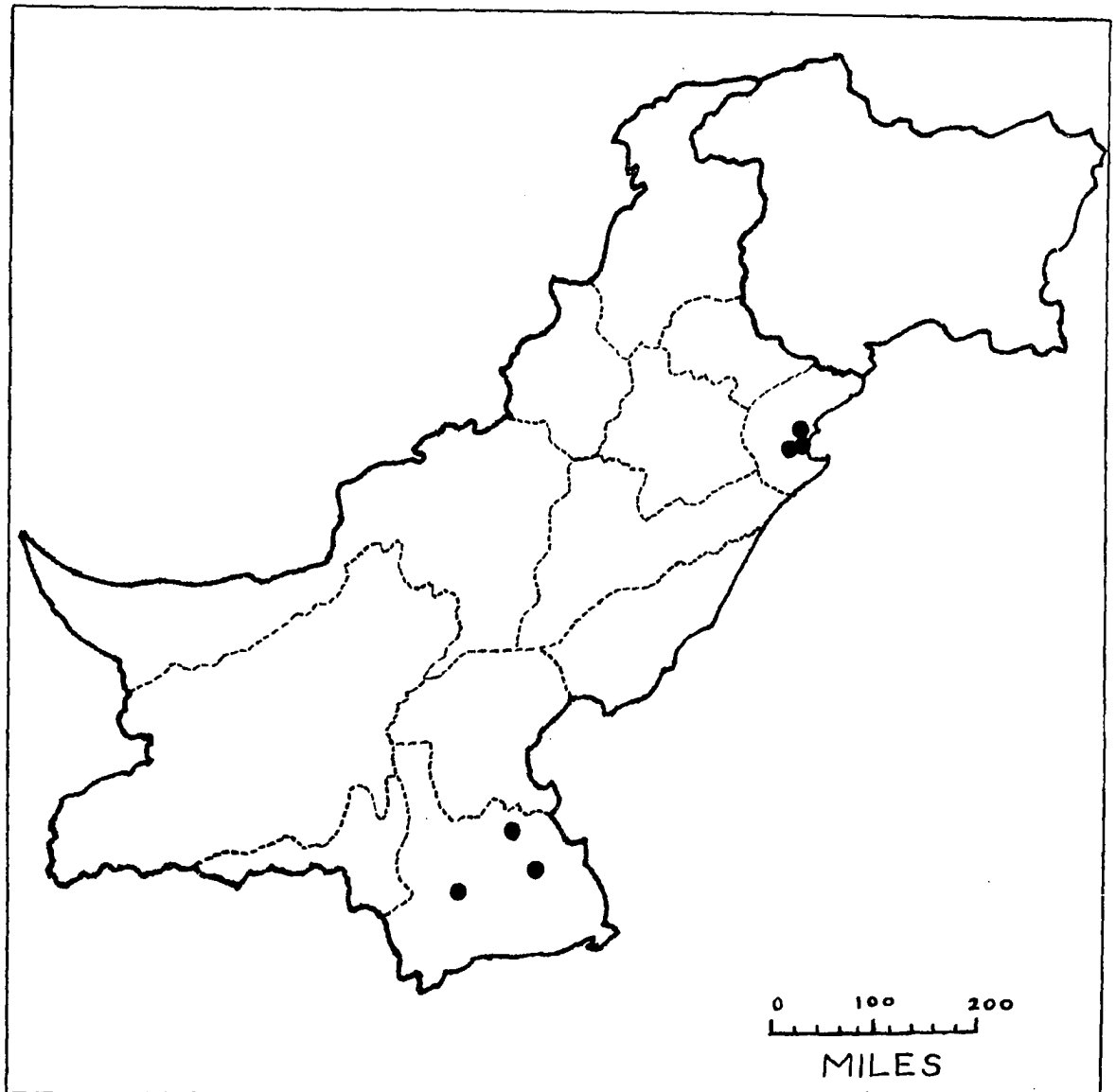


Fig. 13. *Haemaphysalis leachii* (Audouin, 1827). A-G, male: A-scutum; B-coxae I-IV; C-tarsus I; D-tarsus IV; E-spiracular plate; F-capitulum, dorsal view; G-capitulum, ventral view. H-N, female: H-scutum; I-tarsus I; J-tarsus IV; K-spiracular plate; L-coxae I-IV; M-capitulum, dorsal view; N-capitulum, ventral view.



Map XV. Haemaphysalis leachii (Audouin, 1827)  
Geographical distribution — West Pakistan

## HAEMAPHYSALIS MONTGOMERYI NUTTALL, 1912

### Synonymy

#### Haemaphysalis montgomeryi

Nuttall, 1912, Parasitology, 5 (1): 57-59.

Nuttall and Warburton, 1915, Ticks, Pt. 3: 395-397.

Sharif, 1928, Rec. Indian Mus., 30 (3): 246-248.

Hoogstraal, et al., 1966, J. Parasit., 52 (1): 169-191.

### Hosts, Distribution and Biology

Adults of Haemaphysalis montgomeryi are most commonly found on domestic sheep and goats, less frequently from domestic cattle and buffalo and occasionally from horses and dogs. This species has twice been reported feeding on man. The wild host list includes Felis pardus, Marmota caudata caudata, Capricornis sumatraensis humei and Nucifraga caryocatactes multipunctata. Immature stages have been collected from Hemiechinus auritus, Cricetulus sp., Mus sp., Suncus sp., Rattus sp. and Alticola sp.

The range of this tick extends from Dir and Swat through the Kagan Valley, Kashmir and northern India to Nepal. Nearly 50 collections were made in West Pakistan, but only one of these was made south of Rawalpindi (Lahore, Lahore Division). This species is

common in Swat, the Kagan Valley, the hill station areas north of Rawalpindi and throughout Kashmir. It has not been reported to the west of Dir or in the Soviet Union.

While adults of H. montgomeryi have been collected at elevations ranging from 700 ft. to 12,000 ft., this species is most commonly found at elevations ranging from 4,500 ft. to 8,000 ft. Its known distribution is limited to the western Himalayas where the climate ranges from subtropical with mild winters to temperate with extreme winters. Both adults and immature stages have been collected from April through September but their activity in other months is unknown, due mainly to the inaccessibility of the collecting regions during the winter.

#### Disease Relationship

Unknown.

#### Description - Male (Fig.14, A-G)

1. Body. Yellowish to brownish yellow. Ten specimens, length 2.5 mm - 3.4 mm, average 2.9 mm; width 1.3 mm - 1.8 mm, average 1.6 mm.

2. Scutum. Elongate oval, bordered laterally by a narrow strip of integument. Length 2.1 mm - 2.6 mm, average 2.4 mm; width 1.3 mm - 1.6 mm, average 1.5 mm. Scutum widest just anterior of level of dorsal projections of spiracular plates; anterior emarginations wide and shallow, gradually converging to short scapulae, posterior margin

gradually rounded. Cervical grooves short, shallow, concave. Lateral grooves shallow, enclosing first pair of festoons, and extending just into anterior half of scutum. Eleven festoons prominent. Punctations few, small to medium sized shallow and obscure. Eyes absent.

3. Venter. Genital aperture between coxae II. Spiracular plates angular, subquadrangular to subpentagonal, dorsal projections short, widely triangular and tapering to narrow apices. Areas surrounding spiracular plates pilose.

4. Legs. Robust. Coxae each with a prominent, elongately triangular, sharply pointed spur; spurs of II and III subequal; spur of I half again longer than those of II and III; spur of IV twice as long as those of II and III.

5. Capitulum. Average length 0.50 mm, average width 0.48 mm. Basis capituli dorsally approximately 1.3 times as wide as long (including cornua); lateral margins and posterior margin between cornua straight; cornua short, approximately one-third as long as base of basis capituli, widely triangular, apex sharply or bluntly pointed. Palpi compact, lateral saliences reduced. Article 1 short dorsally and ventrally, with a single long seta on each surface. Article 2 slightly longer than wide; dorsobasal margin curving anteriorly from inner margin to lateral surface; ventrobasal margin similar, but extended near inner margin into an elongately triangular, sharply pointed spur reaching to or almost to basal margin of article 1; lateral profile converging anteriorly, inner margin straight or slightly sinuous. Article



3 approximately three-fifths as long as article 2; lateral profile and inner margin converge to gradually rounded apex; dorsobasal margin slightly elevated; ventral spur narrowly elongate, apex sharply pointed, reaching over halfway to base of article 2.

6. Hypostome. Short, blunt. Average length 0.25 mm. Dentition 6/6, teeth small.

#### Description - Female (Fig. 14, H-N)

1. Body. Yellowish brown to dark brown. Eight specimens, length 3.2 mm (unengorged) - 7.5 mm (engorged), width 1.8 mm (unengorged) - 6.3 mm (engorged).

2. Scutum. Shield-shaped (some specimens elongately so). Average length 1.2 mm, average width 1.0 mm. Cervical grooves short, shallow, less concave than in the male. Punctations as in the male.

3. Venter. Genital aperture on level between coxae II, III. Spiracular plates wider and with shorter dorsal projections than in male. Circumspiracular integument with 30 or more setae in a single row except anterodorsally, where the row is double.

4. Legs. As in the male, but with coxal spurs proportionally reduced.

5. Capitulum. Similar to male. Average length 0.57 mm, average width 0.60 mm. Basis capituli twice as wide as long, lateral margins slightly diverging from cornua to apex, cornua slightly shorter and more blunt apically than those of male; porose areas small, widely

spaced, elongately oval. Palps generally similar to the male.

6. Hypostome. Short, blunt. Average length 0.3 mm. Dentition 6/6 to 6.5/6.5, teeth small.

#### Remarks

While its distribution is restricted to the northern hill areas, H. montgomeryi is the most common haemaphysalid parasite of domestic animals in West Pakistan. Adults are commonly found feeding on the ears of the host. In herds containing animals with cropped ears, these animals are far less frequently parasitized.

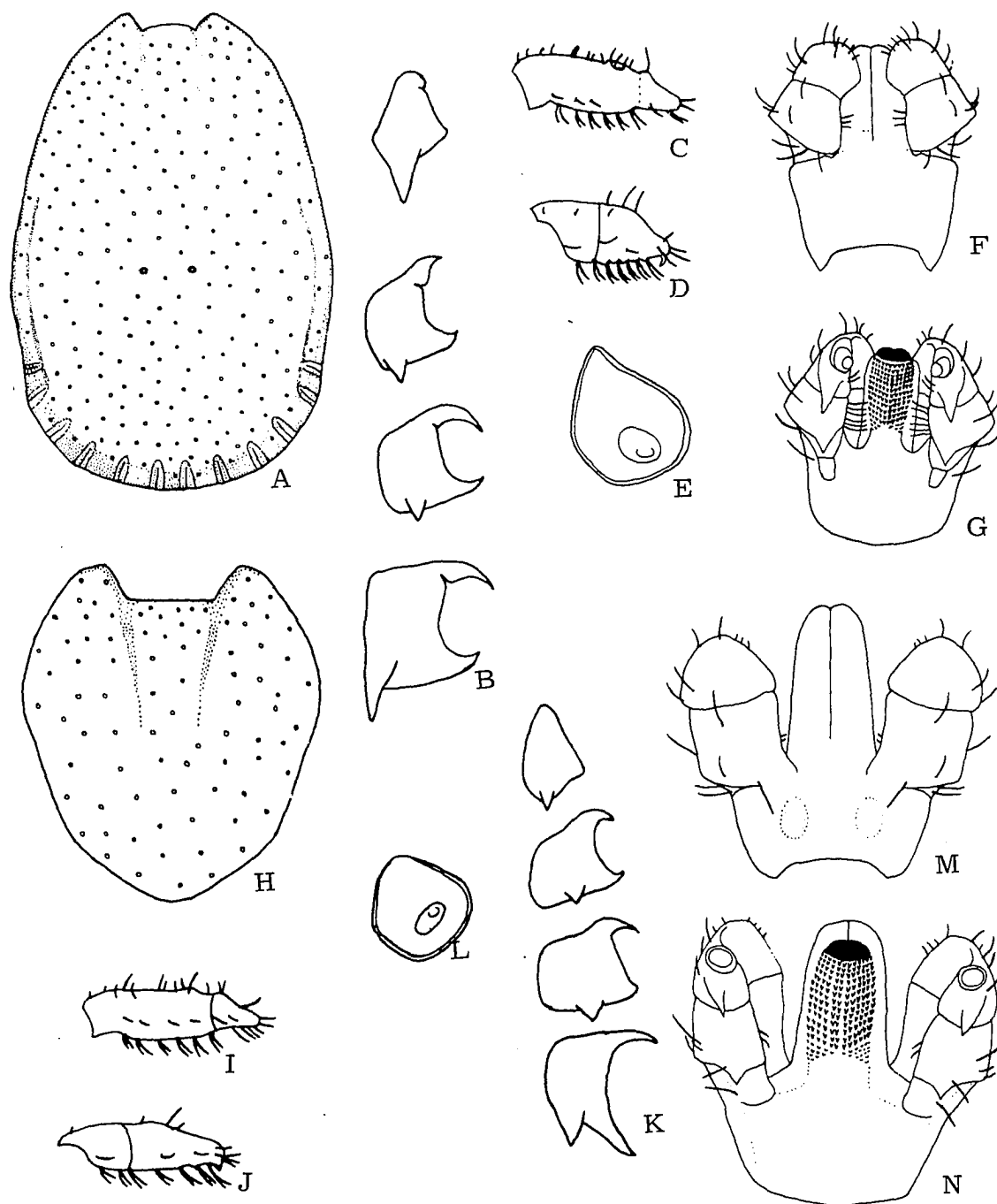
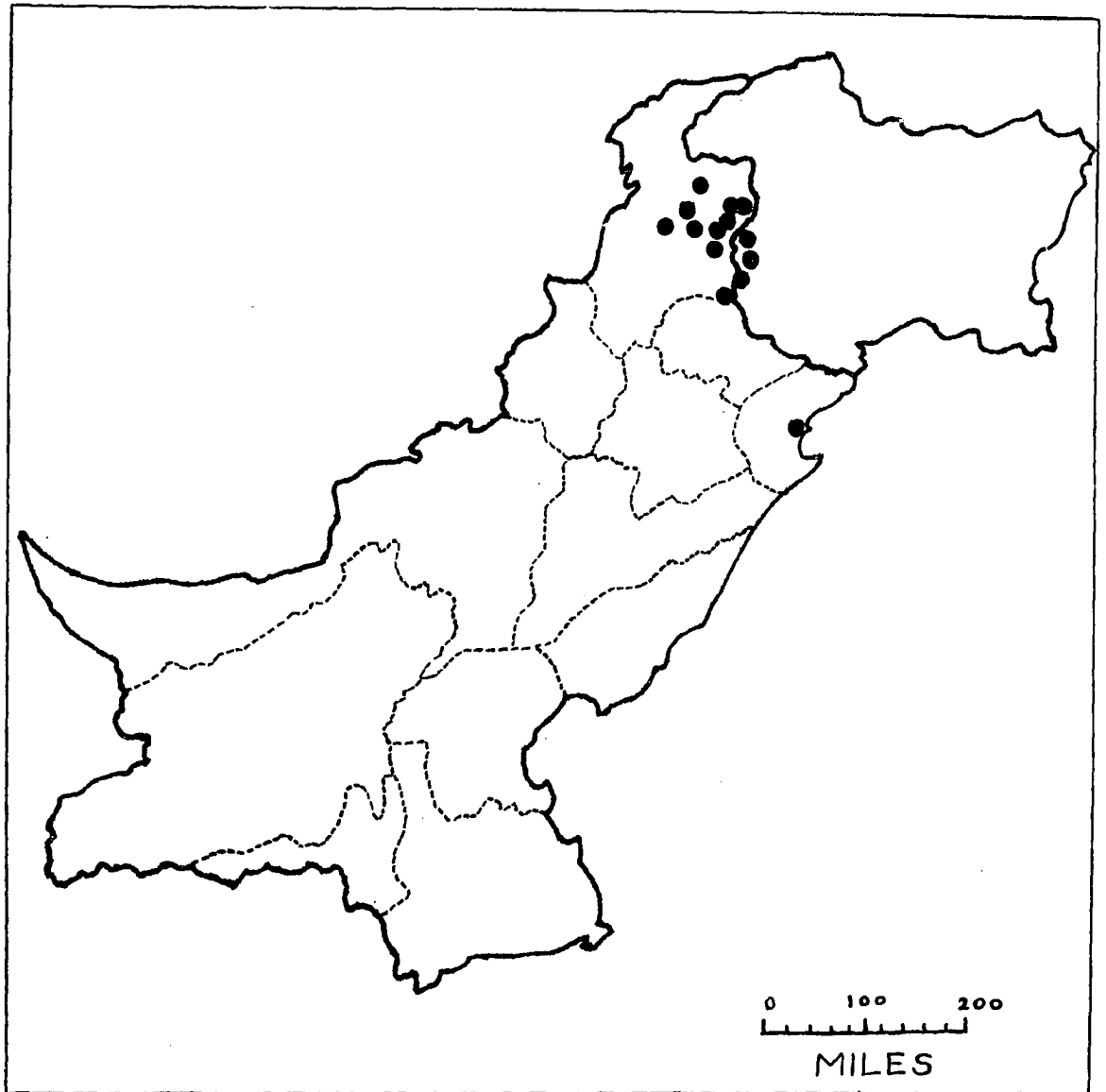


Fig. 14. Haemaphysalis montgomeryi Nuttall, 1912. A-G, male: A-scutum; B-coxae I-IV; C-tarsus I; D-tarsus IV; E-spiracular plate; F-capitulum, dorsal view; G-capitulum, ventral view. H-N, female: H-scutum; I-tarsus I; J-tarsus IV; K-coxae I-IV; L-spiracular plate; M-capitulum, dorsal view; N-capitulum, ventral view.



Map XVI. Haemaphysalis montgomeryi Nuttall, 1912  
Geographical distribution — West Pakistan

HAEMAPHYSALIS SULCATA (CANESTRINI and FANZAGO, 1877)

Synonymy

Herpetobia sulcata

Canestrini and Fanzago, 1877, Atti R. Ist. Veneto Sc. Lett.,  
ser. 5, 4 (1): 69-208.

Haemaphysalis punctata

Berlese, 1889, Padua, Fasc. 55.

Neumann, 1897, Mém. Soc. Zool. France, 10: 324-420 (in part).

Haemaphysalis sulcata

Neumann, 1911, Das Tierreich, Lief. 26 (16): 117 ("doubtful  
species").

Pavlovsky and Pomerantsev, 1934, Trudy Sov. Izuch. Proiz.

Sil. Ser. Zakavkaz, (2): 49-62.

Pomerantsev, 1950, Fauna of the USSR, 4 (2): 95-98.

Anastos, 1957, U. S. Pub. Health Serv. Publ. No. 548: 124-128.

Haemaphysalis cinnabarina var. punctata

Nuttall and Warburton, 1915, Ticks, Pt. 3: 378 (in part).

Haemaphysalis sewelli

Sharif, 1928, Rec. Indian Mus., 30 (3): 243-245.

Hoogstraal and Varma, 1962, J. Parasit., 48 (2): 185-194.

Haemaphysalis cholodkovskii

Olenev, 1928, Dokl. Akad. Nauk SSSR, (2): 29-34.

Delpy, 1938, Ann. Parasitol. Humaine et Comp., 16: 1-10.

### Hosts, Distribution and Biology

In West Pakistan adults of Haemaphysalis sulcata are commonly found on domestic sheep and goats, and occasionally on cattle. Wild hosts include Capra hircus blythi, Ovis orientalis punjabensis, and one female was found feeding on Agama tuberculata. Immature stages have been found on Agama tuberculata, Agama melanura, Agama agroremsis, Agama caucasia, Herpestes edwardsi and Macaca sp.

Anastos (1957) cites the following hosts from various Soviet works: adults—domestic sheep, goats, cattle, horses, buffalo, cat, deer, European and Asiatic mouflons, Ovis musimon, Ovis orientalis cycloceros, and Dama vulgaris. Immature stages parasitize a wide variety of reptiles, birds and mammals: Testudo horsefieldi, Stellio caucasia, Stellio microlepis, Agama aralensis, Agama lehmanni, Eumeces pavimentatus, Albephorus deserti, Eremias velox, Eremias arguta, Eremias variabilis, Eremias regeli, Lacerta taurica, Lacerta viridis, Lacerta agilis, Lacerta depressa, Gymnodactylus fedtschenkoi, Ophiosaurus apus, Ophiosaurus elegans, Eumeces schneideri, Lepus totali, Hemiechinus albulus, Rattus turkestanicus, Phrynocephalus helioscopus horvathi, Eremias stravehi, Eremias pleskei, Contia punctatolineata, Coluber ravergeri, Coronella austriaca, Oenanthe sp., Galerida cristata caucasia, Anthus campestris campestris, Sitta neumayer neumayer, Emberiza melanocephala, Upupa epops and Cri-

cetulus migratorius.

In West Pakistan this species is relatively common in the northern foothill and mountain regions; its range extends through the Potwar plateau westward, and southward into the Sulaiman and Kirthar ranges, to within 100 miles of Karachi. While frequently found north of Quetta City, H. sulcata has not been collected west of this area. Adults have been collected during January, February, March, April, September, October and December; nymphs during March, June, July and August; larvae during March, June and August.

Pakistani collections were from Islamabad, foothills north of Rawalpindi, and Jhelum District in Rawalpindi Division; Gilgit, Mahandri, Shogran, Saidu Sharif and Mansehra in Peshawar Division; Parachinar in D. I. Khan Division; 50 miles west of Hyderabad in Hyderabad Division; Ft. Sandeman and general area, Urrak, Suleman Zai, Chaman, Kingri and Ziarat in Quetta Division.

H. sulcata has been reported from Tibet and northern India through Kashmir, Afghanistan, West Pakistan, Iran, Iraq, Turkey, the Balkans, the Soviet Union, Crete, Sardinia, Sicily, Italy, Israel, Syria, Yemen, Cyprus, Lybia, Egypt, Tunesia, Algeria, Morocco, Corsica and Canary Islands.

Pomerantsev (1950) reported that H. sulcata is primarily a desert-steppe species and is widely distributed mainly in the foothill wormwood and salt semi-deserts of the Caucasus and the central Asiatic republics and also in the mountain steppes of the Caucasus and sec-

ondary xerophytic areas of mountain forest zone with reduced forest plantations. In western Caucasus it is not found in places with humid climate. In these regions adult parasitism occurs in two waves, from March to May and from October to November. However in the central Asiatic republics they are found in small numbers throughout the winter and in some localities the whole year round. Immature stages parasitize from April to August-September, mainly in May-July, larvae being prevalent first, then nymphs.

Pomerantsev (1950) quoted the following laboratory data: "the female lays 2 to 3 thousand eggs; oviposition begins within 10 to 30 days after falling off the host. Development of eggs lasts about 18 to 40 days. Nymphs molt into adults within 23-52 days after feeding."

#### Disease Relationship

Pomerantsev (1950) reported that this species probably causes tick paralysis and can transmit brucellosis to domestic animals.

#### Description - Male (Fig. 15, A-G)

1. Body. Orange brown to brown. Ten specimens, length 3.5 mm - 4.1 mm, average 3.8 mm; width 1.7 mm - 2.1 mm, average 1.9 mm.
2. Scutum. Pyriform, widest just posterior to level of spiracular dorsal projections. Length 3.0 mm - 3.6 mm, average 3.3 mm; width 1.7 mm - 2.1 mm, average 1.9 mm. Cervical grooves moder-



ately deep, short, limited to anterior quarter of scutum. Lateral grooves long, distinct, extending from anterior third of scutum past first pair of festoons. Nine festoons prominent, two more (first pair) weakly formed. Scapulae short, wide. Punctations numerous, small and superficial, extending over entire scutum. Eyes absent.

3. Venter. Genital aperture between coxae II. Spiracular plates tear-shaped, with short but wide dorsal projections.

4. Legs. Moderate. Coxa I with narrow, medium sized, pointed spur; coxae II, III with short, rounded spurs; coxa IV with long, narrow, pointed spur, directed posteriorly, but with a slight posterolateral curve. Trochanter I with numerous, short, white setae on anterior margin.

5. Capitulum. Length 0.60 mm - 0.70 mm, average 0.64 mm; width 0.50 mm - 0.55 mm, average 0.53 mm. Basis capituli quadrangular, wider than long (excluding cornua), slightly wider anteriorly. Cornua long, narrow and pointed. Palps moderately salient; article 2 with short, rudimentary spur on posterodorsal margin; article 3 with prominent, narrow, ventral spur extending over anterior half of article 2.

6. Hypostome. Short, blunt. Average length 0.3 mm. Dentition 5/5, teeth small.

#### Description - Female (Fig. 15, H-N)

1. Body. Yellowish to dark brown. Ten specimens, length 3.7

mm (unengorged) - 14.2 mm (engorged), width 2.1 mm (unengorged) - 7.1 mm (engorged).

2. Scutum. Ovate. Length 1.2 mm - 1.4 mm, average 1.3 mm; width 1.0 mm - 1.2 mm, average 1.1 mm. Lateral margins rounded, convex, widest in midregion; posterior margin broadly angulated. Scapulae short, broad. Cervical grooves deep, distinct and extending into posterior half of scutum. Punctations small, shallow, distinct and uniformly distributed over the scutum. Eyes absent.

3. Venter. Genital aperture on a level between coxae I and II. Spiracular plates subcircular, dorsal projections minute.

4. Legs. Moderate. Coxa I with short, small, triangular spur. Coxae II - IV with poorly developed, broad, comblike ridges. Trochanter I as in the male.

5. Capitulum. Length 0.60 mm - 0.70 mm, average 0.63 mm; width 0.55 mm - 0.70 mm, average 0.61 mm. Basis capituli rectangular, twice as wide as long. Cornua absent, posterior margin of basis straight. Porose depressions of basis large, prominent and ovoid. Palpi triangular with moderate lateral expansion. Article 2 much longer than wide, with a rudimentary, ridgelike projection on posterodorsal margin, ventrally with a row of approximately 12 feathery infrainternal setae. Article 3 with a short ventral spur nearly reaching anterior margin of article 2.

6. Hypostome. Average length 0.33 mm. Dentition 4/4 to 5/5, teeth small.

## Remarks

In 1928 Sharif described Haemaphysalis sewelli from two female specimens collected off a goat near Abbottabad. The cotype was later redescribed by Hoogstraal and Varma (1962). Pomerantsev (1950) and Anastos (1957) considered H. sewelli to be a synonym of H. sulcata. Recent collections from areas near Abbottabad yielded several female specimens which fit both the Pomerantsev description of H. sulcata and the Hoogstraal and Varma redescription of H. sewelli. Moreover male specimens, associated with these females, fit the Pomerantsev description of H. sulcata (the male of H. sewelli is unknown). Considering also the wide distribution of H. sulcata around West Pakistan and its host preference for sheep and goats, it is probable that H. sewelli is a synonym for H. sulcata.

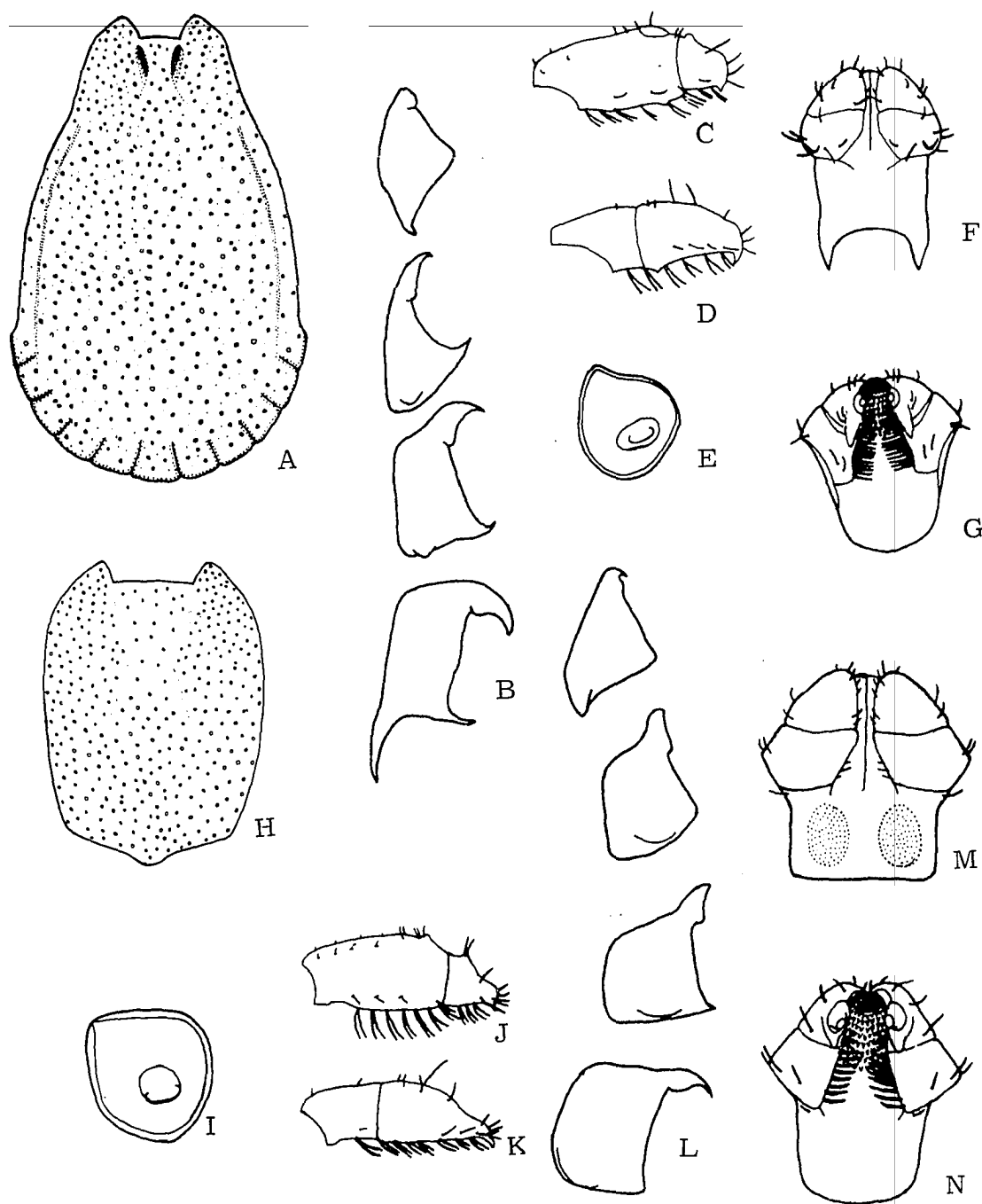
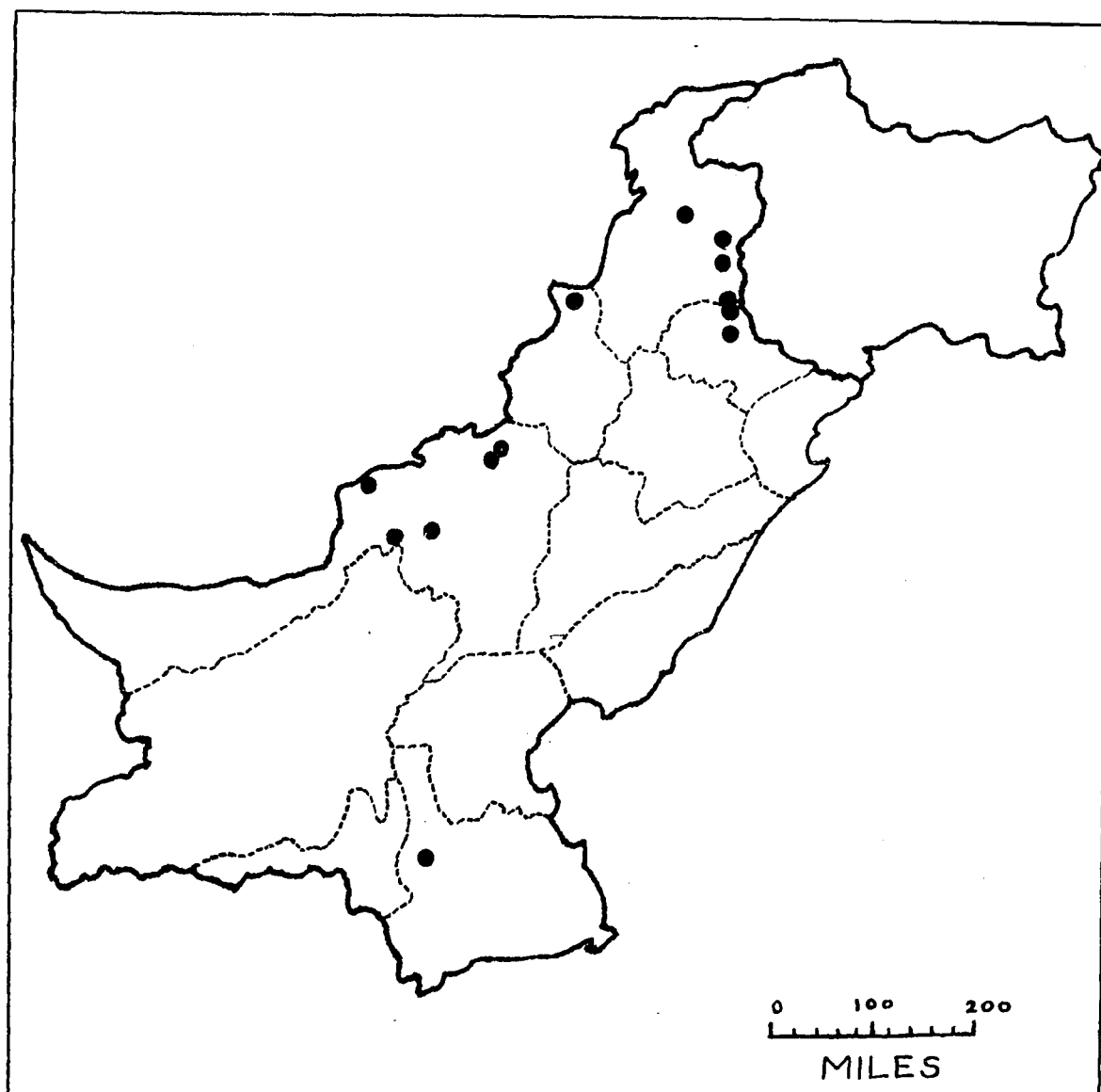


Fig. 15. Haemaphysalis sulcata (Canestrini and Fanzago, 1877).  
 A-G, male: A-scutum; B-coxae I-IV; C-tarsus I;  
 D-tarsus IV; E-spiracular plate; F-capitulum, dorsal  
 view; G-capitulum, ventral view. H-N, female:  
 H-scutum; I-spiracular plate; J-tarsus I; K-tarsus IV;  
 L-coxae I-IV; M-capitulum, dorsal view; N-capitulum,  
 ventral view.



Map XVII. Haemaphysalis sulcata (Canestrini and Fanzago, 1877)  
Geographical distribution — West Pakistan

## GENUS HYALOMMA KOCH, 1844

### Introduction

The eleven Hyalomma species of West Pakistan constitute a large varied, important and virtually unstudied group. Several other species found in neighboring countries may possibly also occur in Pakistan.

The Hyalomma warrant especial interest for several reasons. Their high degree of individual variation raises many problems in taxonomy, and their exceptional ability as vectors of human and animal pathogens constitutes a subject of prime medical and veterinary importance. Of all the ticks, collected from all sources in West Pakistan, nearly two-thirds belong to this genus. The host list for Hyalomma ranges from the tortoise up through the birds and virtually all of the mammals; and in West Pakistan this genus is found wherever hardticks have been collected.

The systematics of this genus are in dispute among several groups of taxonomists. This work follows the classification system of Kaiser and Hoogstraal (1964). The following paragraph and keys (with some modifications) are taken from their paper.

### SUBGENERA of HYALOMMA

Species in the genus Hyalomma fall into three natural and distinct groups that can quite conveniently be considered as subgenera.

The frequently accepted though moot names Hyalommina, Hyalommasta, and Hyalomma are retained for these subgenera. It will obviously be some time before subgeneric designations of Hyalomma are settled to the full satisfaction of taxonomic purists. In brief, Neumann (1901), Salmon and Stiles (1901), Nuttall and Warburton (1911), and Opinion 73 of the International Rules of Nomenclature have considered H. aegyptium to be the type species of the genus. H. aegyptium therefore should be the type species of the subgenus Hyalomma. However, the subgenus Hyalommasta was erected by Schulze (1930a) for H. aegyptium. Other workers, especially the Russian school represented by Pomerantsev (1950), as well as Santos Dias (1956), consider H. dromedarii to be the type species of the genus. If this opinion were accepted, the discrepancies noted above could be more easily resolved. The subgenus Hyalommina is equally troublesome, having been erected by Schulze (1919) for H. rhipicephaloides, and later "replaced" by Santos Dias (1956) as a new subgenus, Delpyiella. Feldman-Muhsam (1957), however, considered Hyalommina as a full generic category.

Key to HYALOMMA Subgenera

1. Basis capituli ventrally with lateral projections. Adanal shields very broad. Subanal shields absent.....  
..... Subgenus Hyalommina  
Basis capituli lacking ventral lateral projections. Adanal shields elongate. Subanal shields present (absent in atypical specimens).....2
2. Coxa I with two equal, well separated spurs. Subanal shields rudimentary, sometimes absent (H. aegyptium).....  
.....Subgenus Hyalommasta  
Coxa I deeply divided into narrow external spur and wider internal spur. Subanal shields well developed.....  
..... Subgenus Hyalomma

SUBGENUS HYALOMMINA

## Key to the Males

1. Lateral grooves superficial, long, short, or absent. Punctations shallow. Tarsus IV humped. Scutum, legs, capitulum and ventral shields yellowish brown to deep reddish brown...  
.....kumari  
Lateral grooves distinct and long. Punctations discrete. Tarsus IV flat or slightly humped. Scutum, legs, capitulum, and ventral shields reddish brown .....2



2. Punctations large, few, widely scattered. Median and paramedian grooves deep and distinct. Spiracular plates elongate oval.....hussaini
- Punctations small, moderately numerous adjacent to lateral grooves and posteriorly. Median and paramedian grooves less distinct. Spiracular plates comma-shape.....brevipunctata

#### Key to the Females

1. Operculum (= genital apron) profile slightly bulging; outline elongately oval. Scutum, legs, and capitulum pale yellowish brown to reddish brown. Tarsus IV humped.....kumari
- Operculum profile bulging anteriorly, depressed or sloping posteriorly. Scutum, legs, and capitulum reddish brown. Tarsus IV flat or slightly humped.....2
2. Operculum wide, surface somewhat depressed medioposteriorly. Punctations large, very few in median field. Cervical grooves distinct .....hussaini
- Operculum an elongate oval, surface not depressed medioposteriorly. Punctations fine, numerous in lateral and cervical fields, more widely scattered posteriorly. Cervical grooves poorly developed.....brevipunctata

SUBGENUS HYALOMMA

## Key to the Males

1. Lateral grooves short, not reaching central third of scutum.  
Punctations few on central scutum..... 2  
Lateral grooves reaching beyond posterior third of scutum.  
Punctations variable.....6
2. Subanal shields well developed, situated exterior to axis of  
adanal shields. Adanal shields often curved posteriorly to-  
wards each other. Posteromedian groove may or may not  
reach parma.....3  
Subanal shields situated on the axis of the adanals (unen-  
gorged specimens). Adanal shields straight. Posteromedian  
groove not reaching parma..... 5
3. Very large, robust ticks. Spiracular plate short, wide, oval;  
dorsal projection short, blunt..... schulzei  
Medium-large ticks. Spiracular plate comma-shaped; dorsal  
projection long, thin.....4
4. Cervical grooves long, deep, extending to mid-scutum. Sub-  
anal shields narrow, pointed and prominent.....  
..... asiaticum asiaticum  
Cervical grooves moderate and shallow. Subanal shields  
broad and curved..... dromedarii
5. Small, frail, pale ticks; scutal length never greater than

- 3.85 mm. Ridges beside caudal field weakly elevated if at all. Subanal shields elongate, weakly chitinized, often rudimentary or absent ..... anatolicum anatolicum
- Large, robust, dark ticks; scutal length 4.00 mm - 6.00 mm, seldom less. Ridges beside caudal field distinctly elevated. Subanal shields less elongate, heavily chitinized, seldom if ever rudimentary or absent. .... anatolicum excavatum
6. Scutum brown. Punctations numerous ..... 7
- Scutum dark glossy brown. Punctations few, scattered, large ..... 8
7. Subanal shields situated on midaxis of adanal shields; parma absent; scutal punctations dense ..... marginatum turanicum
- Subanal shields exterior to the midaxis of adanal shields; parma usually present; scutal punctations moderate. .... impeltatum
8. With a (usually white) parma. Leg segments with dorsal white stripe. Cervical grooves shallow. .... detritum
- Without parma. Leg segments with sharply defined rings on joints. Cervical grooves deep. .... marginatum isaaci

#### Key to the Females

1. Operculum (= genital apron) profile gradually depressed posteriorly; outline triangular ..... 2
- Operculum profile flat or bulging; outline variable. .... 4

2. Operculum bordered by a V-shaped lip, giving trilobate appearance..... 3  
 Operculum widely triangular, without V-shaped lip on border, leg segments usually with white, dorsal stripe..... detritum
3. Large tick; scutal punctations few and large. Operculum narrowly triangular..... dromedarii  
 Medium sized tick; scutal punctations numerous and of moderate size. Operculum triangular (shorter and wider than that of dromedarii)..... impeltatum
4. Operculum round to elongate oval, bulging..... 5  
 Operculum widely triangular..... 7  
 Operculum subrectangular. A very large tick. Scutum as wide as long, with a moderate number of very large punctations ..... schulzei
5. Operculum small, round, knoblike..... 6  
 Operculum elongate oval..... asiaticum asiaticum
6. Scutal length less than 2.00 mm. Color yellowish brown to brown. Scutum weakly chitinized, punctations large and shallow ..... anatolicum anatolicum  
 Scutal length usually more than 2.00 mm. Color reddish brown to dark brown. Scutum heavily chitinized, punctations large and moderately deep..... anatolicum excavatum
7. Scutum dark glossy brown with few, scattered, large punctations; cervical grooves well developed. Legs with white,

narrow, sharply defined rings. Operculum profile slightly  
 bulging ..... marginatum isaaci  
 Scutum brown with many punctations; cervical grooves less  
 pronounced. Legs with less contrasting white rings or  
 stripes. Operculum profile bulging... marginatum turanicum

SUBGENUS HYALOMMASTA

HYALOMMA AEGYPTIUM (LINNAEUS, 1758)

Synonymy

Acarus aegyptius

Linnaeus, 1758, Systema Naturae, Regnum Animale, ed. 10: 615.

Hyalomma syriacum

Koch, 1844, Arch. Naturgesch., 10: 222.

Sharif, 1928, Rec. Indian Mus., 30 (3): 311-313.

Sen, 1938, Indian Jour. Vet. Sci. and Animal Husbandry, 8: 133  
-147.

Hyalomma aegyptium

Schulze, 1930, Zeitschr. Parasitenk., 3 (1): 28, 29.

Pomerantsev, 1950, Fauna of the USSR, 4 (2): 193-195.

Hoogstraal, 1956, African Ixodoidea, Vol. I, Ticks of the Sudan:  
514-516.

Nagar, 1962, Ent. Bull. (India), (3): 58-61.

Kaiser and Hoogstraal, 1964, Acarologia, 6 (2): 260, 261.

Hosts, Distribution and Biology

In West Pakistan one collection of Hyalomma aegyptium adults  
was taken off Testudo elongata, 46 miles E. of Quetta, on 9 April 1963.

Arthur (1963) lists the following distribution for H. aegyptium: Russia, France, Asia Minor, Turkey, Tunisia, Libya, Egypt, Greece, Senegal, Congo, South Africa, Afghanistan, Israel and West Pakistan. Hoogstraal (1956) restricts the known distribution to the Mediterranean area, Russia, Asia Minor, the Near East, Afghanistan, Iran and West Pakistan; pointing out that due to the taxonomic confusion and misidentification of this species by earlier workers, older distribution reports should be viewed with suspicion.

Pomerantsev (1950) gives the following data for H. aegyptium in the Soviet Union:

Development is of the three-host pattern. Adults parasitize from April to July. Larvae and nymphs are seen in June, July and August. Maximum activity of adults occurs in the middle of June. Larvae placed on turtles in the Fall will remain on the host from 24 days to three months. It is very probable that the turtles take them into their burrows in hibernation. The ticks finish their development here and molt to immature adults towards the beginning of April.

Judging from its distribution this form is primarily a desert-steppe one. The species is specific for turtles of genus Testudo and is fairly frequent on hedgehogs; there are known collections from donkey, dog and hamster.

To this group Hoogstraal (1956) adds lizards (Agama), partridges, man, hares and a wide variety of rodents as hosts for the immature stages of H. aegyptium.

#### Disease Relationship

Hoogstraal (1956) emphasizes that H. aegyptium has never been incriminated as a vector or reservoir of pathogenic organisms of man,

other mammals, or birds, and states that only Haemogragarina [sic] mauritana, H. stepanovi and Coelomoplasma hyalommae have been associated with this tick. However Arthur (1963) states that some workers incriminate H. aegyptium as the vector of bovine piroplasmosis and of east coast fever (Theileria parva). Once again the answer hinges on the correct identification of the tick vector in these reports.

#### Description - Male (Fig. 16, A-H)

1. Body. Brown, medium sized to large. Four specimens, length 5.2 mm - 6.5 mm, average 6.0 mm; width 3.0 mm, average 3.4 mm.
2. Scutum. Dark brown, ovate, widest in posterior half and strongly arched. Length 3.8 mm - 5.0 mm, average 4.4; width 2.6 mm - 3.3 mm, average 3.0 mm. Cervical grooves short and deep, other grooves absent, 11 unfused festoons present. Eyes small, round, slightly convex, deeply socketed. Punctations medium sized, shallow, moderate in number, and distributed randomly over the dorsum.
3. Venter. Grayish yellow. Genital aperture between coxae II. Adanal shields subtriangular to quadrangular. Subanal shields are rudimentary and situated below the adanals. Spiracular plates elongate comma-shaped.
4. Legs. Brown with white rings on distal end of each segment. Coxae I - IV with widely separated, moderate, double spurs.



5. Capitulum. Length 1.3 mm - 1.5 mm, average 1.4 mm; width 0.7 mm - 0.9 mm, average 0.8 mm. Basis capituli rectangular. Palps long and strong.

6. Hypostome. Long, average length 0.8 mm, bluntly rounded. Dentition 3/3, teeth moderate.

#### Description - Female ( Fig. 16, I-P)

1. Body. Grayish brown. Four specimens, length 6.6 mm (partially engorged) - 12.4 mm (fully engorged); width 3.6 mm (partially engorged) - 7.3 mm (fully engorged). Many short, fine setae in nonscutal areas.

2. Scutum. Brown. Length 2.5 mm - 2.9 mm, average 2.7 mm; width 2.6 mm - 2.7 mm, average 2.7 mm. Shape subcircular, widest in middle region. Cervical grooves commence anteriorly as deep pits, rapidly becoming shallow and extending two-thirds the length of the scutum. Eyes circular, deeply socketed. Punctations large, moderate in number, and limited mainly to scapular regions and cervical grooves.

3. Venter. Grayish brown. Genital aperture between coxae II, subquadrangular, posterior margin rounded. Spiracular plates oval with small dorsal projection.

4. Legs. As in the male.

5. Capitulum. Similar to that of the male. Lateral margins indented, posterior margin faintly indented. Porose areas shallow, in-

conspicuous.

6. Hypostome. As in the male. Average length 0.9 mm.

#### Remarks

Adults of this species can easily be identified by the well separated spurs on coxae I. This character sets the species apart from all other Hyalomma thus far collected in West Pakistan.

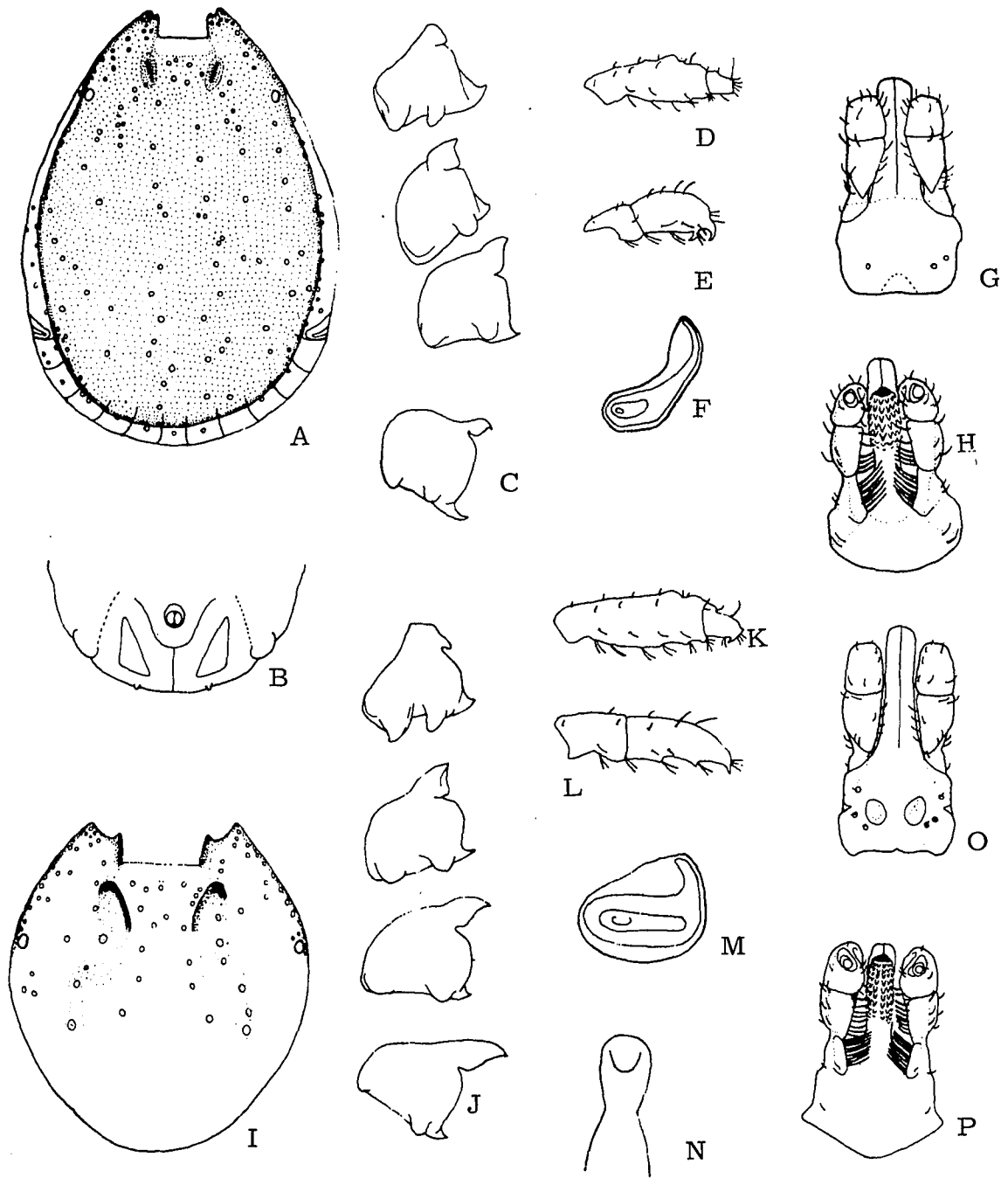
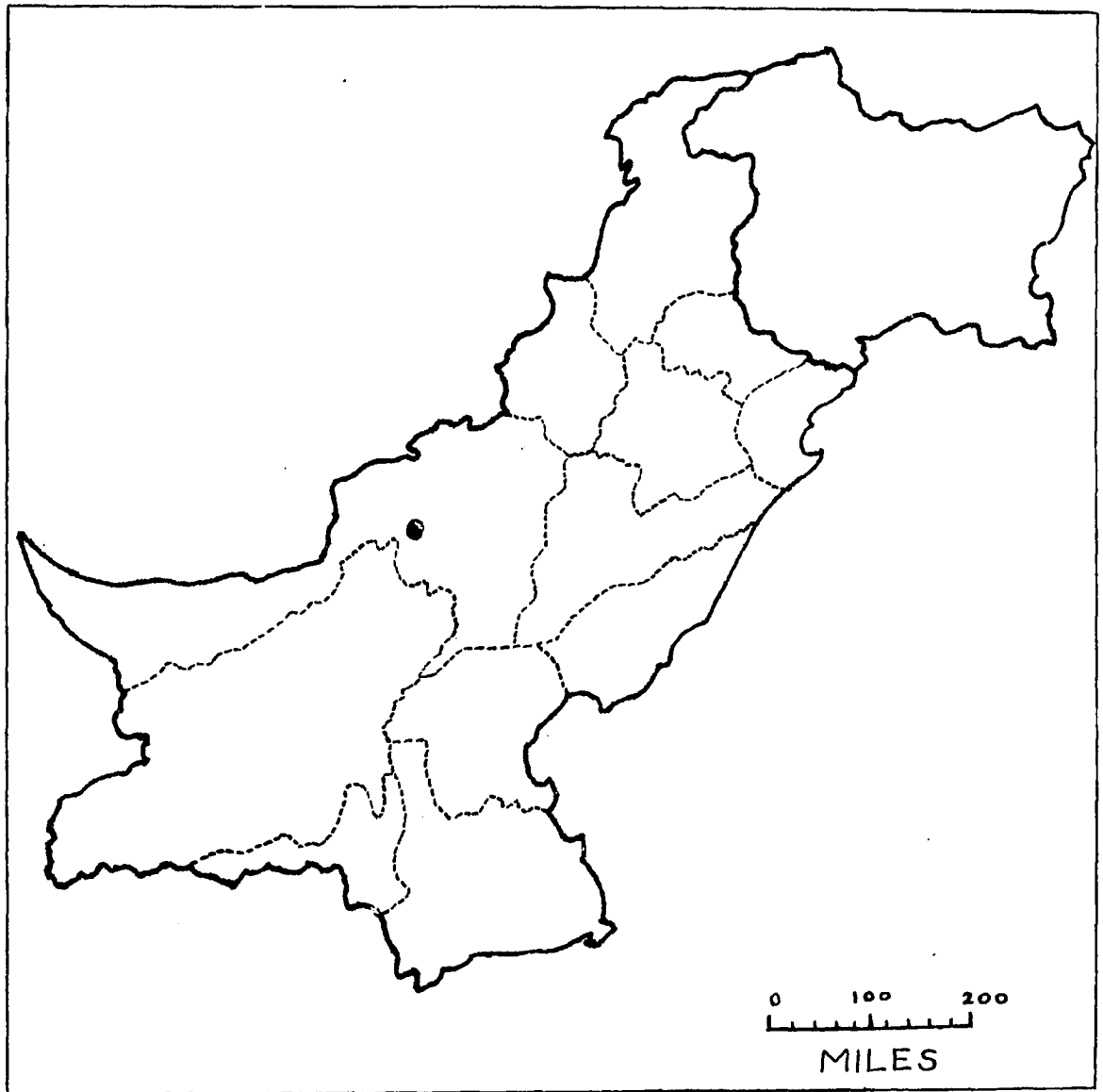


Fig. 16. *Hyalomma aegyptium* (Linnaeus, 1758). A-H, male: A-scutum; B-adanal, accessory and subanal shields; C-coxae I-IV; D-tarsus I; E-tarsus IV; F-spiracular plate; G-capitulum, dorsal view; H-capitulum, ventral view. I-P, female: I-scutum; J-coxae I-IV; K-tarsus I; L-tarsus IV; M-spiracular plate; N-genital aperture; O-capitulum, dorsal view; P-capitulum, ventral view.



Map XVIII. Hyalomma aegyptium (Linnaeus, 1758)  
Geographical distribution — West Pakistan

SUBGENUS HYALOMMINA

HYALOMMA BREVIPUNCTATA SHARIF, 1928

Synonymy

Hyalomma hussaini var. brevipunctata

Sharif, 1928, Rec. Indian Mus., 30 (3): 318.

Feldman-Muhsam, 1957, Parasitology, 47 (1, 2): 46-59

(species inquirenda).

Hyalomma brevipunctata

Kaiser and Hoogstraal, 1963, J. Parasit., 49 (1): 130-139

(new combination).

Kaiser and Hoogstraal, 1964, Acarologia, 6 (2): 257-286.

Hosts, Distribution and Biology

Adults of Hyalomma brevipunctata have been collected from domestic cattle, goats, buffalo, dogs, camels and man. Wild hosts include "blue bull", Sambar deer (Cervus unicolor niger) and spotted deer (Axis a. axis). Larvae have been collected from Rattus rattus rufescens, Mus booduga and Millardia sp.

Only one specimen has been reported from West Pakistan (1♂, human, Karachi, January, 1944). Elsewhere this species has frequently been reported from India, mainly from the central and eastern

areas.

Little is known about the biology of H. brevipunctata save that it has been recorded from such diverse areas as the Kutch deserts and Bengal jungles.

#### Disease Relationship

Unknown.

#### Description - Male (Fig. 17, A-H)

1. Body. Light brown. Four specimens, length 3.2 mm - 3.8 mm, average 3.4 mm; width 1.5 mm - 1.9 mm, average 1.7 mm.

2. Scutum. Ovate, widest in posterior half. Length 2.5 mm - 3.1 mm, average 2.7 mm; width 1.5 mm - 1.7 mm, average 1.6 mm. Cervical grooves short, deep pits. Lateral grooves long, deep, distinct, dotted with heavy, usually contiguous punctations. In the caudal area three longitudinal, heavily punctate depressions represent the posteromedian and paramedian grooves. Twin, faint, subrectangular depressions lie at mid-scutum, slightly inside the lateral grooves. The anterior and posterior quarters of the scutum contain a moderate number of small and medium sized punctations. The scutal mid-regions generally lack punctation, save in the aforementioned lateral grooves. Eyes small, circular, orbited and convex.

3. Venter. Cream yellow, similar in form to that of H. kumari.

4. Legs. Yellowish brown to reddish brown. Coxae as in H.

kumari, tarsi generally longer and less humped than those of H. kumari.

5. Capitulum. Average length 0.8 mm, average width 0.6 mm. Basis capituli subpentagonal, wider than long, with anterior lateral projections visible on the ventral side.

6. Hypostome. Long, bluntly rounded, average length 0.6 mm. Dentition 3/3, teeth strong.

#### Description - Female (Fig. 17, I-P)

1. Body. Light brown. Four specimens, length 3.9 mm (unengorged) - 4.2 mm (partially engorged), width 1.8 mm (unengorged) - 2.3 mm (partially engorged).

2. Scutum. Subcordiform. Average length 1.7 mm, average width 1.5 mm, widest above level of the eyes. Cervical grooves start as small, deep pits which widen rapidly to become shallow depressions extending to the posterolateral margins. Punctations small to moderate in scapular and anteromedian areas. Punctations moderate to large in cervical grooves. Posteromedian area relatively free from punctations. Eyes small, circular, convex and deeply socketed.

3. Venter. Yellowish brown to reddish brown. Genital aperture between coxae II. Operculum elongate oval, depressed posteriorly, with minute, membranous posteromedian lip. Spiracular plates comma-shaped.

4. Legs. Orange brown. Similar to the male and to H. kumari.

Tarsi IV slightly humped.

5. Capitulum. Average length 1.1 mm, average width 0.8 mm. Basis capituli subpentagonal, wider than long; with anterior, lateral projections visible on the ventral side. Palps long. Cornua minute. Porose areas ovate, with a laterally directed ridge extending from their posterior margins.

6. Hypostome. Long, bluntly rounded, average length 0.7 mm. Dentition 3/3, teeth strong.

#### Remarks

As only one male specimen has been reported from West Pakistan, material collected by the Virus Research Centre of Poona, India was used in this work for illustration and description. These ticks were collected from cattle in Gujerat State, India and are part of the Hoogstraal tick collection (No. 2727 HY).

The Pakistani specimen is most likely a stray, as numerous subsequent collections in the Karachi area have not yielded additional members of this species. Moreover, as man is not a normal host for this species, and since Karachi is the major seaport for West Pakistan, this might well be a case of seaborne importation.

Feldman-Muhsam (1957) questions the validity of H. hussaini var. brevipunctata (= H. brevipunctata). She points out that this group appears to be intermediate between H. hussaini and H. kumari, notes the high degree of variation in the subgenus, and recommends that



rearing experiments be undertaken to determine the range of variation of the individual species. Singh and Dhanda (1965) have reared nymphs and larvae from all three members of this subgenus, and have stated that they were unable to separate the larvae and could only separate nymphs of H. hussaini from the others. They found only slight interspecific differences between nymphs of H. kumari and H. brevipunctata and a high degree of intraspecific variation.

In view of the foregoing work, it is with reservations that the validity of H. brevipunctata is accepted. Additional investigation in this group is needed.

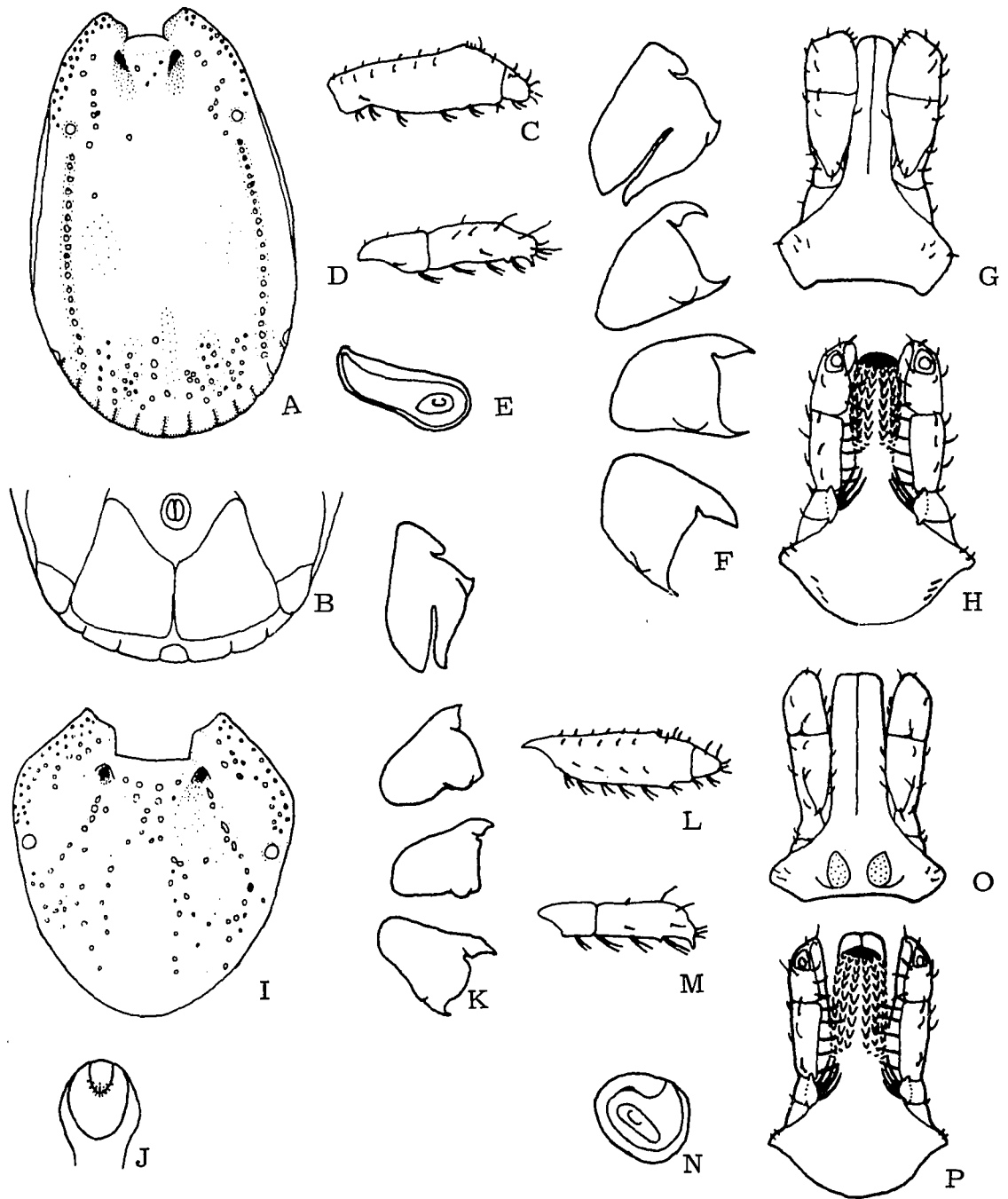
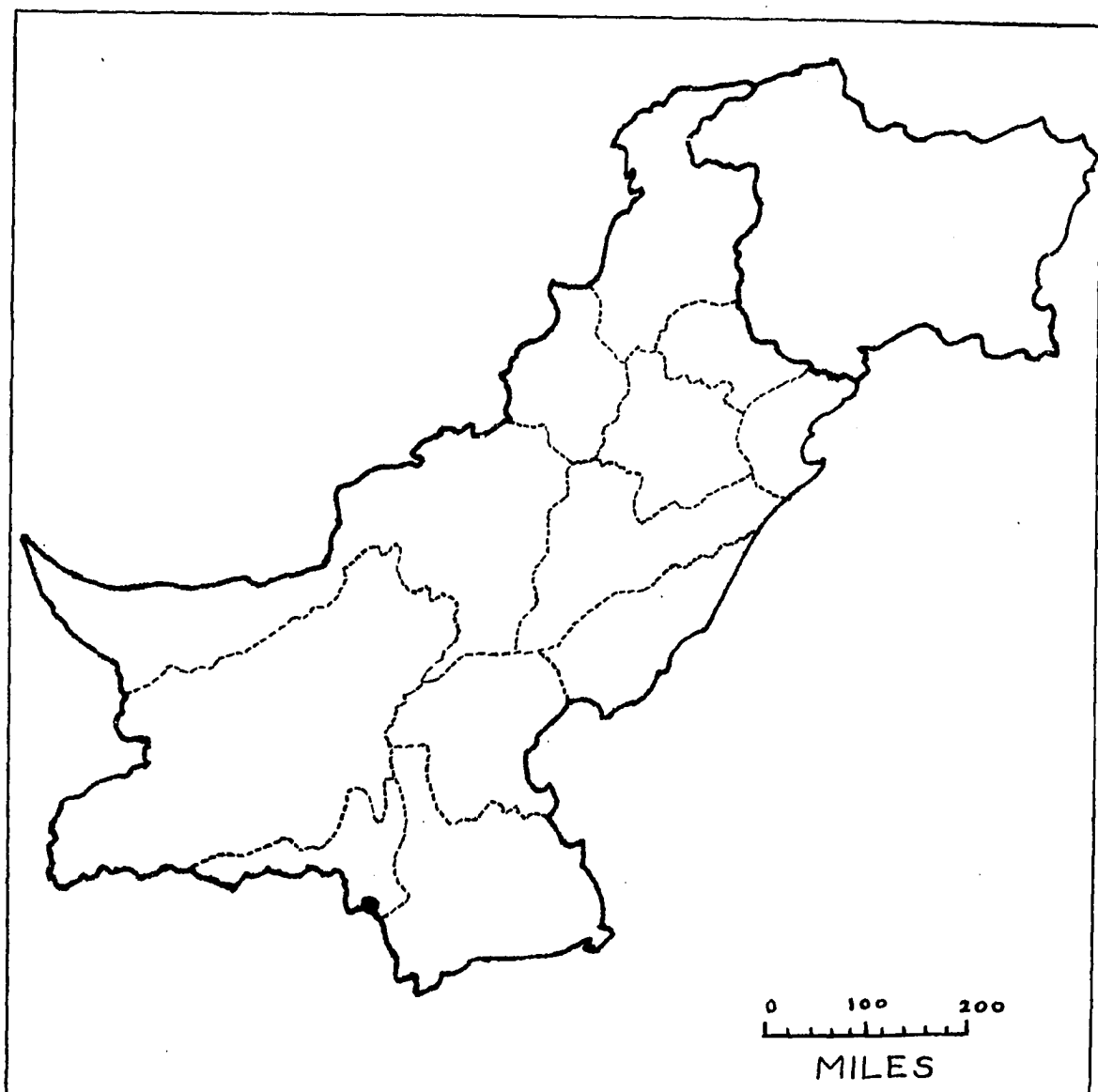


Fig. 17. *Hyalomma brevipunctata* Sharif, 1928. A—H, male: A—scutum; B—adanal and accessory shields; C—tarsus I; D—tarsus IV; E—spiracular plate; F—coxae I-IV; G—capitulum, dorsal view; H—capitulum, ventral view. I—P, female: I—scutum; J—genital aperture; K—coxae I-IV; L—tarsus I; M—tarsus IV; N—spiracular plate; O—capitulum, dorsal view; P—capitulum, ventral view.



Map XIX. Hyalomma brevipunctata Sharif, 1928  
Geographical distribution — West Pakistan

HYALOMMA HUSSAINI SHARIF, 1928

Synonymy

Hyalomma hussaini

Sharif, 1928, Rec. Indian Mus., 30 (3): 314-318.

Feldman-Muhsam, 1957, Parasitology, 47 (1, 2): 46-59.

Kaiser and Hoogstraal, 1964, Acarologia, 6 (2): 257-286.

Hosts, Distribution and Biology

In West Pakistan Hyalomma hussaini has been collected from domestic cattle and a horse. Elsewhere cattle, buffalo, camels, horses, sheep and dogs serve as hosts for the adult stages. Singh and Dhanda (1965) report that one nymphal pelt has been picked off Rattus rattus rufescens.

H. hussaini has been found in three widely differing regions in West Pakistan. All three regions are in Hyderabad Division. Umar-kot is a dry, hot, sandy region. Buhara is a sea influenced, seasonally swampy lowland 62 miles E.S.E. of Karachi. Tatta is 63 miles E. of Karachi in the lower Indus basin, and is a dry, but well irrigated area.

H. hussaini is widely distributed throughout India (Sharif, 1928), but has not been found outside of the Pak-Indian subcontinent.

## Disease Relationship

Unknown.

## Description - Male (Fig. 18, A-H)

1. Body. Dark reddish brown. Eight specimens, length 3.1 mm - 3.4 mm, average 3.3 mm; width 1.6 mm - 1.8 mm, average 1.7 mm.
2. Scutum. Ovate. Length 2.4 mm - 2.7 mm, average 2.6 mm; width 1.5 mm - 1.7 mm, average 1.6 mm. Cervical grooves short, wide deep pits. Deep, distinct, moderately punctate lateral grooves reach almost to the level of the eyes. Posteromedian and paramedian grooves short, deep, distinct and heavily punctate. Punctations on scutum few, large and randomly scattered. Eleven short festoons present.
3. Venter. Yellowish brown. Genital aperture between coxae II. Adanal shields broad with faintly curved posterior edge. Subanal shields absent. The spiracular plates are subovate, widest in posterior region. The borders of the macula are irregular and indented.
4. Legs. Orange brown. Strong. Coxae similar to those of H. kumari, tarsi similar to those of H. brevipunctata.
5. Capitulum. Average length 0.8 mm, average width 0.6 mm. Basis capituli subpentagonal, posterior margin slightly concave, cornua minute. Anterior lateral projections on ventral side. Palps long

and strong.

6. Hypostome. Long, blunt. Average length 0.6 mm. Dentition 3/3, teeth large.

#### Description - Female (Fig. 18, I-P)

1. Body. Reddish brown. Four specimens, length 4.0 mm (unengorged) - 5.5 mm (partially engorged); width 2.1 mm (unengorged) - 3.2 mm (partially engorged).

2. Scutum. Cordiform. Length 1.6 mm - 1.8 mm, average 1.7 mm; width 1.5 mm - 1.7 mm, average 1.6 mm. Cervical grooves start as narrow deep pits, proceed posteriorly as broad, shallow depressions and reach to the posterolateral margins. Punctations few, large, mainly in cervical grooves and on scapular margins.

3. Venter. Yellowish brown to reddish brown. Genital aperture slightly below posterior margins of coxae II. The operculum is shield-shaped and somewhat depressed medioposteriorly. The spiracular plates are subtriangular, and the borders of the macula are irregular and indented. The dorsal projection is short and thick.

4. Legs. As in the male.

5. Capitulum. Average length 1.1 mm, average width 0.8 mm. Basis capituli subpentagonal, posterior margin slightly concave, dorsal depressions deep and ovate, cornua minute. Palps long and strong. Anterior lateral projections present on ventral side of basis.

6. Hypostome. Long, blunt. Average length 0.8 mm. Denti-

tion 3/3, teeth large.

#### Remarks

This species is not common in West Pakistan, and has not been reported north of Umarmot in Hyderabad Division. Several other species of Hyalomma have been collected from domestic animals in ecologically similar regions 75 to 100 miles north of Umarmot.

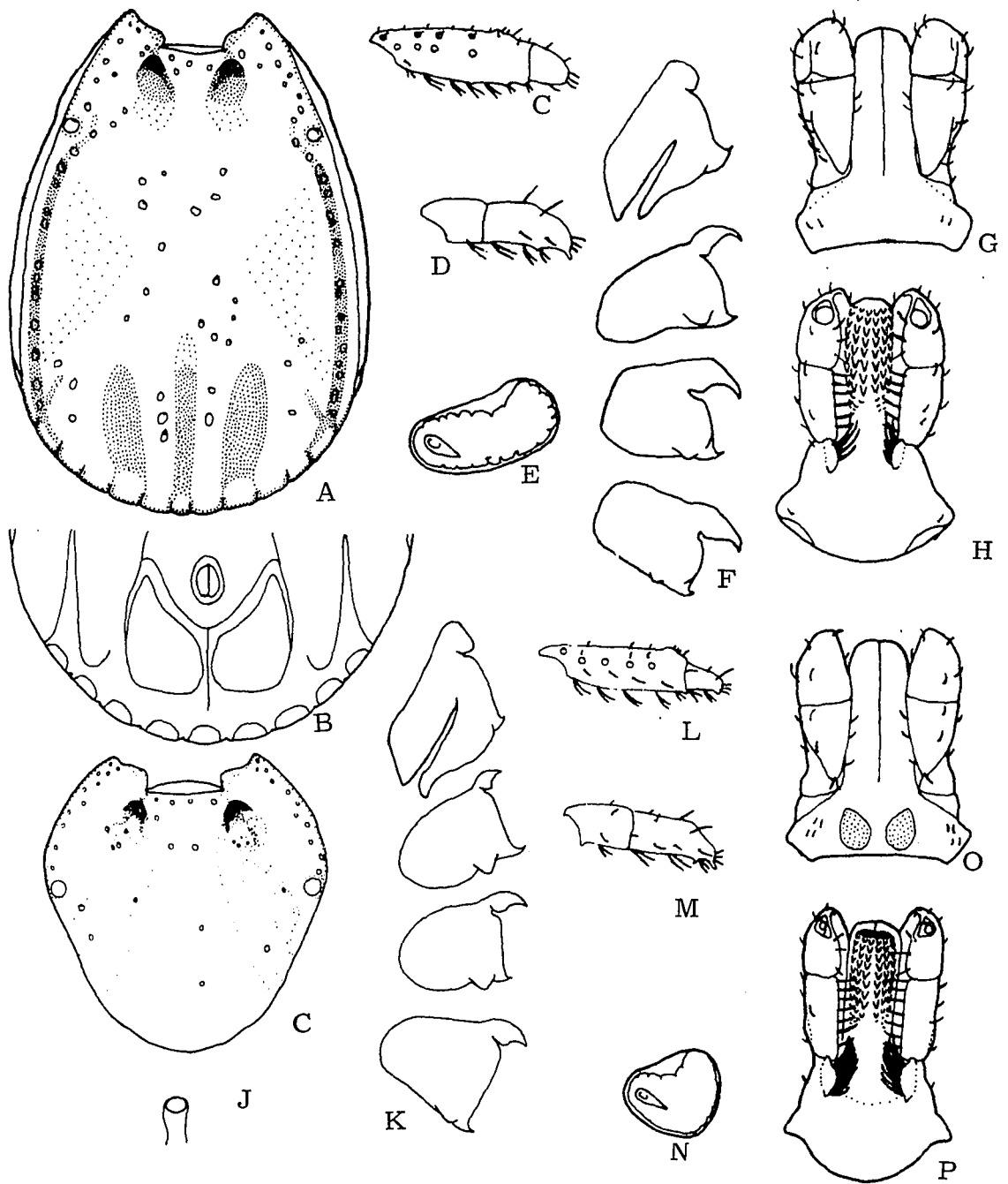
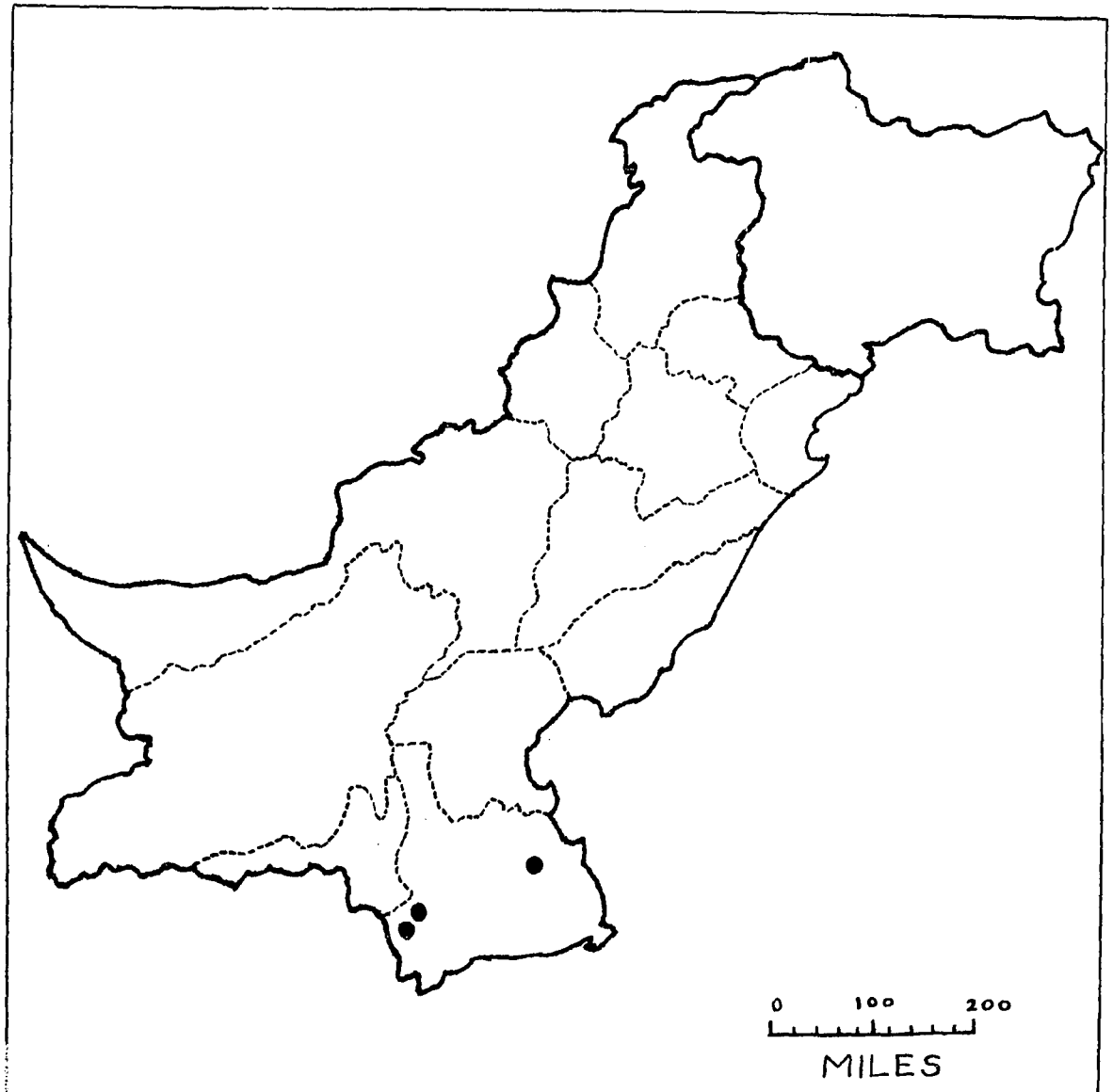


Fig. 18. *Hyalomma hussaini* Sharif, 1928. A—H, male: A—scutum; B—Anal and accessory shields; C—tarsus I; D—tarsus IV; E—spiracular plate; F—coxae I-IV; G—capitulum, dorsal view; H—capitulum, ventral view. I—P, female: I—scutum; J—genital aperture; K—coxae I-IV; L—tarsus I; M—tarsus IV; N—spiracular plate; O—capitulum, dorsal view; P—capitulum, ventral view.





Map XX. Hyalomma hussaini Sharif, 1928  
Geographical distribution – West Pakistan

HYALOMMA KUMARI SHARIF, 1928

Synonymy

Hyalomma kumari

Sharif, 1928, Rec. Indian Mus. , 30 (3): 319-320.

Feldman-Muhsam, 1957, Parasitology, 47 (1, 2): 46-59.

Kaiser and Hoogstraal, 1964, Acarologia, 6 (2): 257-286.

Hosts, Distribution and Biology

In West Pakistan, Hyalomma kumari adults are most commonly found on domestic and wild goats (Capra hircus blythi). Elsewhere, adults of this species have been collected from domestic goats, wild goats (Hemitragus hylocrius), domestic sheep, dogs, cattle, horses and a tiger. Immature stages have been reported (by Singh and Dhanda, 1965) on Rattus rattus rufescens and found on Calomyscus (?) sp.

H. kumari has been reported from West Pakistan, India, Afghanistan and Nepal. Little is known about its ecology, save that it has been found in such dissimilar regions as the Himalayan foothills and the Great Rann of Cutch (=Kutch). Collections in West Pakistan have been made from the outliers of the Kirthar range, 50 miles W. of Hyderabad, and Nagar Parkar in Hyderabad Division.

## Disease Relationship

Unknown.

## Description - Male (Fig. 19, A-H)

1. Body. Yellowish brown to reddish brown. Ten specimens, length 3.4 mm - 3.9 mm, average 3.6 mm; width 1.7 mm - 2.0 mm, average 1.8 mm.
2. Scutum. Ovate. Length 2.7 mm - 3.2 mm, average 2.9 mm; width 1.7 mm - 1.9 mm, average 1.7 mm. Cervical grooves short deep pits; lateral grooves medium to long, shallow, partially obscured by small and medium sized punctations. Posteromedian and paramedian grooves represented by shallow, punctate depressions. Shallow twin depressions are present at the mid-scutal level. In addition to the aforementioned punctations, moderate numbers are found on the scapular and anteromedian regions. Eyes are small, circular, convex and deeply socketed.
3. Venter. Pale yellowish brown. Genital aperture between coxae II. Adanal shields broad and rectangular; subanals absent. Spiracular plates comma-shaped.
4. Legs. Yellowish to reddish brown, strong. Coxa I with large double spurs in close apposition; inner spur broad and pointed, outer spur long, narrow, with curved point. Coxae II - IV with single weak spurs. Tarsi IV (sometimes others) humped.

5. Capitulum. Average length 0.8 mm, average width 0.7 mm. Palps long. Basis capituli subpentagonal, much wider than long. Weak cornua present. Blunt, anterior, lateral projections on ventral part of basis.

6. Hypostome. Long, bluntly rounded, average length 0.6 mm. Dentition 3/3, teeth strong.

#### Description - Female (Fig. 19, I—P)

1. Body. Color as in the male. Ten specimens, length 4.1 mm (unengorged) - 8.0 mm (engorged); width 2.1 mm (unengorged) - 4.8 mm (engorged).

2. Scutum. Subcordiform. Length 1.8 mm - 2.2 mm, average 2.0 mm; width 1.7 mm - 1.9 mm, average 1.8 mm. Cervical grooves start as short, deep pits, and rapidly widen to form shallow depressions extending to the posterolateral margins of the scutum. Medium to large punctations are numerous in scapular and anterolateral (anterior to eyes) regions and in the cervical grooves. A moderate number of punctations are present in anteromedian regions but the posteromedian field is relatively smooth. Eyes are as in the male.

3. Venter. Color as in the male. Genital aperture on a level with the posterior margins of coxae II. Operculum longitudinally oval, and slightly bulging in profile. Posterior margin partially surrounded by cup-like structure. Spiracular plates oval, with short, strong dorsal projection.

4. Legs. As in the male.

5. Capitulum. Much longer, wider than in the male. Average length 1.2 mm, average width 0.8 mm. Lateral projections of basis capituli strong, blunt, both dorsally and ventrally. Cornua minute. Palps long, strong, article 3 longer than that of male. Dorsal depressions of basis capituli ovate, small, but partially enclosed by large ridges.

6. Hypostome. Shaped as in the male but longer, average length 0.8 mm. Dentition 3/3, teeth strong.

#### Remarks

Kaiser and Hoogstraal (1964) noted some variation between Indian and Pakistani collections of H. kumari. One collection from domestic goats at Nagar Parkar (C 813, 27♂, 21♀, 7 February 1964, Mc Carthy and Mirza) shows considerable individual variation in both color and form. Dr. Kaiser considers these ticks to be atypical specimens of H. kumari; however some of these exhibit features associated with the other members of this subgenus. This problem is discussed further under H. brevipunctata "Remarks".

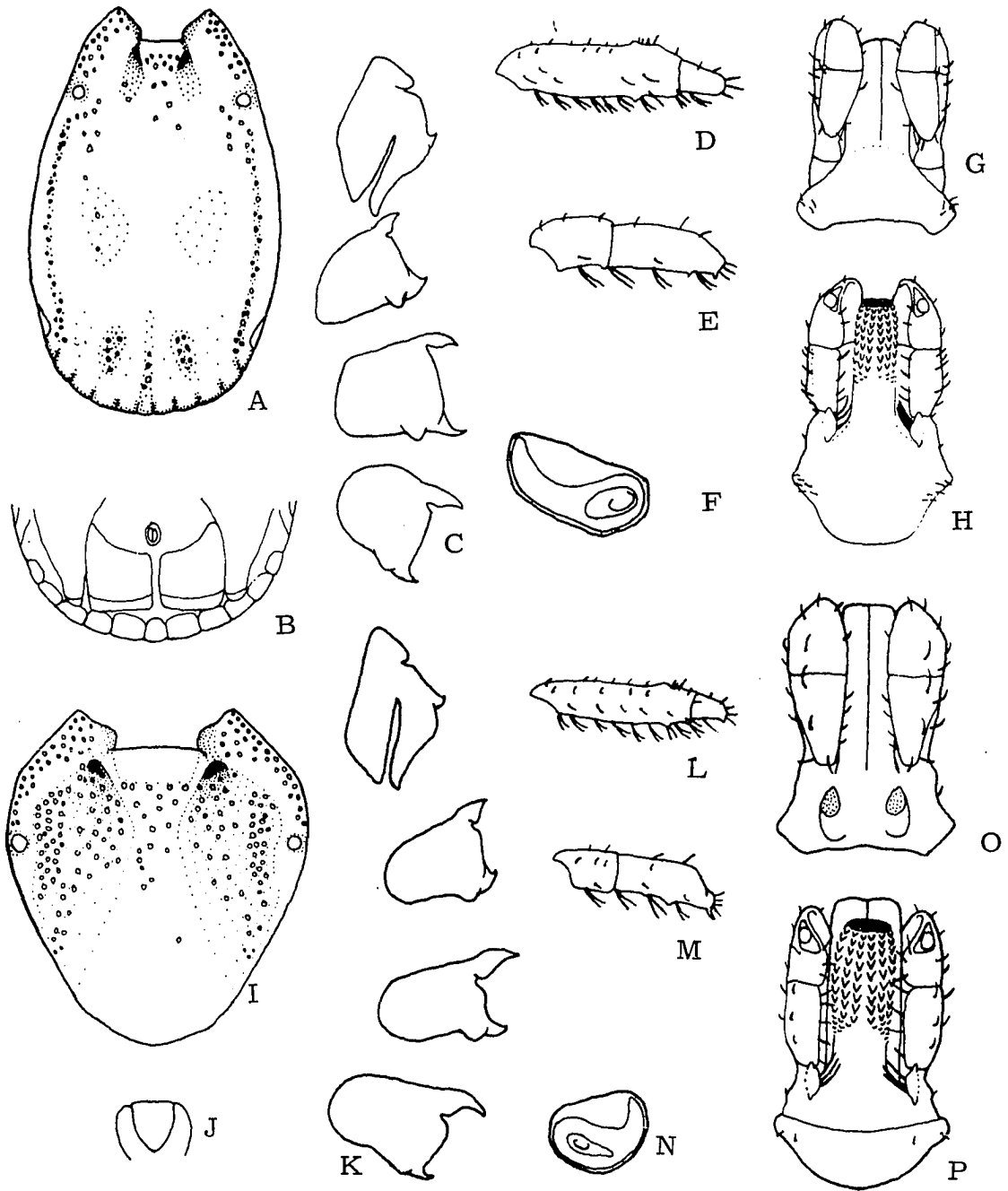
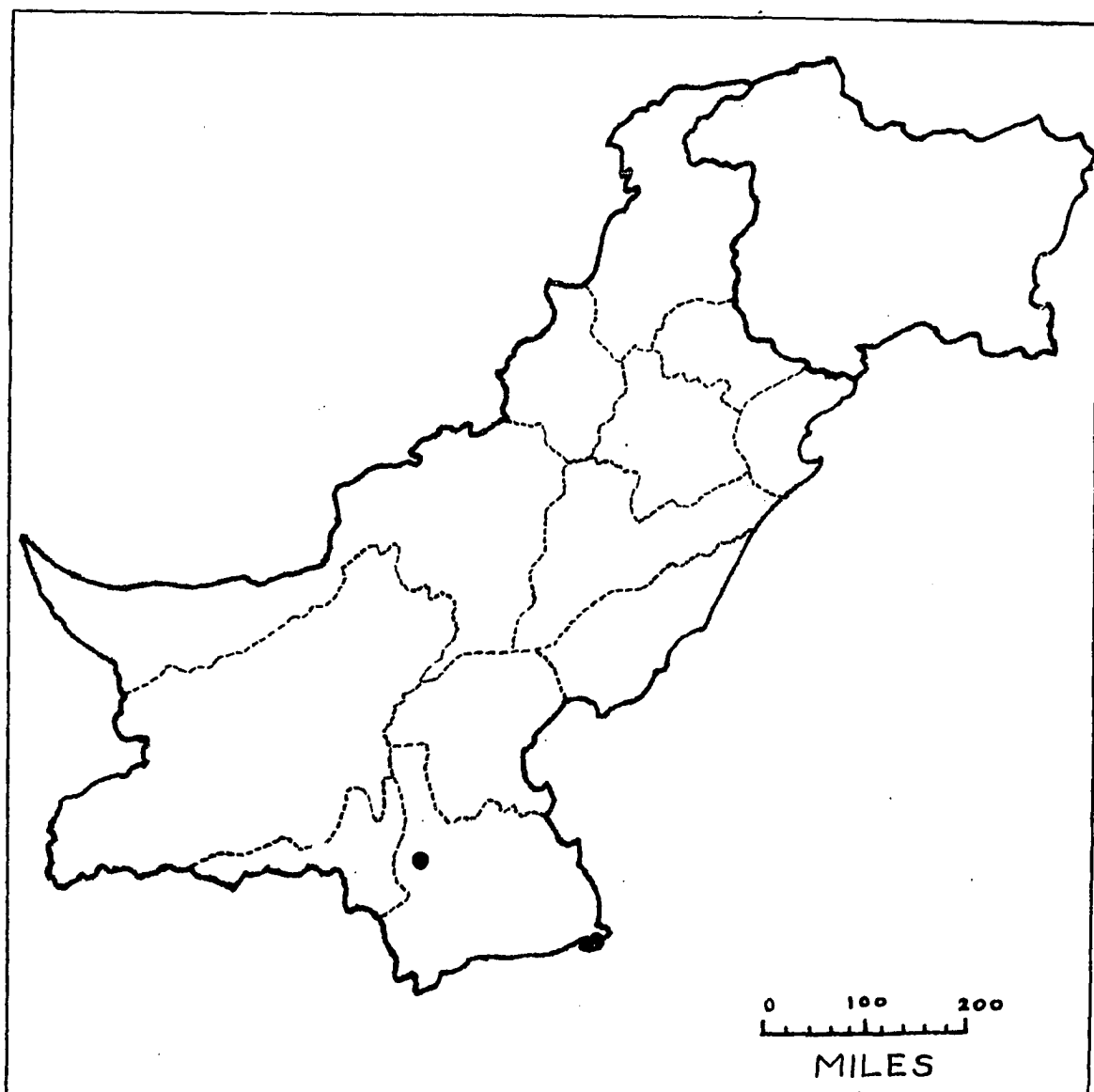


Fig. 19. Hyalomma kumari Sharif, 1928. A-H, male: A-scutum; B-adanal and accessory shields; C-coxae I-IV; D-tarsus I; E-tarsus IV; F-spiracular plate; G-capitulum, dorsal view; H-capitulum, ventral view. I-P, female: I-scutum; J-genital aperture; K-coxae I-IV; L-tarsus I; M-tarsus IV; N-spiracular plate; O-capitulum, dorsal view; P-capitulum, ventral view.



Map XXI. Hyalomma kumari Sharif, 1928  
Geographical distribution — West Pakistan

SUBGENUS HYALOMMA

HYALOMMA ANATOLICUM ANATOLICUM KOCH, 1844

Synonymy

Hyalomma anatolicum

Koch, 1844, Arch. Naturgesch. , 10 (1): 217-239.

Hyalomma anatolicum anatolicum

Pomerantsev, 1946, Opred. Faune SSSR Zool. Muz. Akad.

Nauk, Leningrad, 26: 24, 27.

Pomerantsev, 1950, Fauna of the USSR, 4 (2): 211-214.

Hoogstraal and Kaiser, 1959, Ann. Ent. Soc. Amer. , 52 (3):  
243-261.

Kaiser and Hoogstraal, 1963, J. Parasit. , 49 (1): 130-139.

Kaiser and Hoogstraal, 1964, Acarologia, 6 (2): 257-286.

Hyalomma excavatum

Delpy, 1946, Ann. Parasitol. Humaine et Comp. , 21 (5-6):  
267-293.

Feldman-Muhsam, 1954, Bull. Res. Counc. Israel, 4 (2): 150-  
170.

Tendeiro, 1955, Bol. Cult. Guiné Portuguesa, 10 (39): 319-461.

Hoogstraal, 1956, African Ixodoidea, Vol. I, Ticks of the Sudan:  
435-451.



Anastos, 1957, U. S. Pub. Health Serv. Publ. No. 548: 149-153.

Hyalomma savignyi

Kratz, 1940, Zeitschr. Parasitenk., 11 (4): 510-562.

Adler and Feldman-Muhsam, 1946, Refuah Vet., 3 (3): 91-94.

Hyalomma rhipicephaloides

Neumann, 1901, Mém. Soc. Zool. France, 14 (2-3): 249-372.

### Hosts, Distribution and Biology

Kaiser and Hoogstraal (1964) state that adults of Hyalomma anatolicum anatolicum feed on all domestic animals and immature stages usually feed on the same hosts as adults. In an earlier paper (Hoogstraal and Kaiser, 1959) they noted that distribution of the subspecies is generalized, adults and immature stages are seldom on hosts in winter (North Africa), and immature stages are found chiefly on larger domestic animals or wild animals no smaller than hares. Pom-erantsev (1950) cites reports which show a similar pattern in the Soviet Union, and states that the developmental cycle requires one year. H. a. anatolicum appears to follow the same pattern in West Pakistan. Over 600 collections of adults were made from domestic mammals: buffalo, cattle, camel, horse, goat and sheep. Infrequent wild hosts were: Canis aureus, Lepus nigricollis, Lepus capensis tibetanus, Vulpes bengalensis, Bosephalus tragocamelus, Herpestes auropunctatus, Felis chaus, Paraechinus hypomelas blanfordi and Centropus sinensis.

This subspecies is the most common tick in West Pakistan. It is found in every division and in the widest possible range of climatic conditions. It is most common in spring, summer and fall, but it has been collected throughout the calendar year. Outside of West Pakistan it has been reported from India, Afghanistan, Iran, Iraq, the Soviet Union, the Near and Middle East, southeastern Europe and northern Africa.

#### Disease Relationship

This subspecies is considered by Rybalko, et al., (1963) to be a probable vector of the agent of hemorrhagic fever in southern Kazakhstan. It may also be a vector of Uzbekistan hemorrhagic fever virus and Coxiella burneti in the Soviet Union.

H. a. anatolicum is considered an important vector of Theileria annulata in cattle and benign piroplasmiasis in nestling birds.

#### Description - Male (Fig. 20, A-H)

1. Body. Pale yellowish brown. Eighteen specimens, length 3.1 mm - 3.9 mm, average 3.5 mm; width 1.6 mm - 2.0 mm, average 1.8 mm.

2. Scutum. Yellowish brown to reddish brown, ovate. Length 2.5 mm - 3.1 mm, average 2.8 mm; width 1.4 mm - 1.8 mm, average 1.6 mm. Cervical grooves short, shallow. Lateral grooves short, sometimes indistinct. Caudal region depressed; posteromedian and

paramedian grooves present as faint depressions within the larger caudal depression. Festoons and a small white parma present; the latter separated from the posteromedian groove by a narrow ridge. Punctations small and shallow, present mainly in the anterior half of the scutum and in the caudal depression. Eyes small, circular and deeply socketed.

3. Venter. Pale yellow. Genital aperture between coxae II. Adanal shields elongate, with usually straight external margins. Subanal shields variable (sometimes rudimentary or absent) and situated on the midaxis of the adanals. Spiracular plates comma-shaped, with long dorsal projections.

4. Legs. Slender, pale yellowish brown. Coxa I with the narrow pointed outer spur and broader inner spur typical of the subgenus. Coxa II with moderate outer spur, coxae III, IV may or may not have rudimentary inner spurs; most frequently weak ridges are seen in these regions.

5. Capitulum. Length 0.7 mm - 0.9 mm, average 0.8 mm; width 0.5 - 0.6 mm, average 0.5 mm. Basis capituli quadrangular, narrowing posteriorly. Posterior margin straight, cornua minute.

6. Hypostome. Average length 0.5 mm. Dentition 3/3, teeth small.

#### Description - Female (Fig. 20, I-P)

1. Body. Yellowish brown to brown. Sixteen specimens, length

4.3 mm (unengorged) - 14.0 mm (engorged); width 1.9 mm (unengorged) - 8.0 mm (engorged).

2. Scutum. Cordiform, slightly longer than wide and narrowly rounded posteriorly. Length 1.5 mm - 1.9 mm, average 1.7 mm; width 1.5 mm - 1.9 mm, average 1.7 mm. Cervical grooves commencing as deep pits, becoming shallow and extending to the posterolateral margins. Punctations shallow and variable, most common in scapular and central regions. Eyes prominent, circular and deeply socketed.

3. Venter. Yellowish brown. Genital aperture between coxae II. Operculum round, knoblike and bulging. Spiracular plates subovate with short dorsal projections.

4. Legs. As in the male.

5. Capitulum. Average length 1.0 mm, average width 0.7 mm. Palps long, slender. Posterior margin of basis straight. cornua minute. Porose areas ovate.

6. Hypostome. Average length 0.7 mm. Apical end bluntly rounded, dentition 3/3, teeth moderate.

#### Remarks

Hoogstraal and Kaiser (1959) have presented a comprehensive review of this species and have put forth several cogent reasons for reducing H. excavatum to the subspecific level and placing other species in synonymy. Much confusion has attended the taxonomic history of

this group and at this date several problems remain. This work follows the scheme of Hoogstraal and Kaiser which in turn follows the Soviet school (notably Pomerantsev). Unfortunately earlier workers (Delpy, Feldman-Muhsam, etc.) have used a system wherein H. anatolicum and H. excavatum are considered species of equal rank and have reversed the names. Thus Hyalomma anatolicum anatolicum (sensu Pomerantsev) = Hyalomma excavatum (sensu Delpy), and Hyalomma anatolicum excavatum (sensu Pomerantsev) = Hyalomma anatolicum (sensu Delpy).

As members of this group are vectors of several viral, rickettsial and protozoan agents, their taxonomic status is of great epidemiological and epizootical importance, and care must be taken in accepting previous vector identifications.

Nagar (1962) used Hoogstraal's 1956 key when he surveyed the Hyalomma of Delhi State. Therefore it is probable that his "Hyalomma excavatum" is actually Hyalomma anatolicum anatolicum.

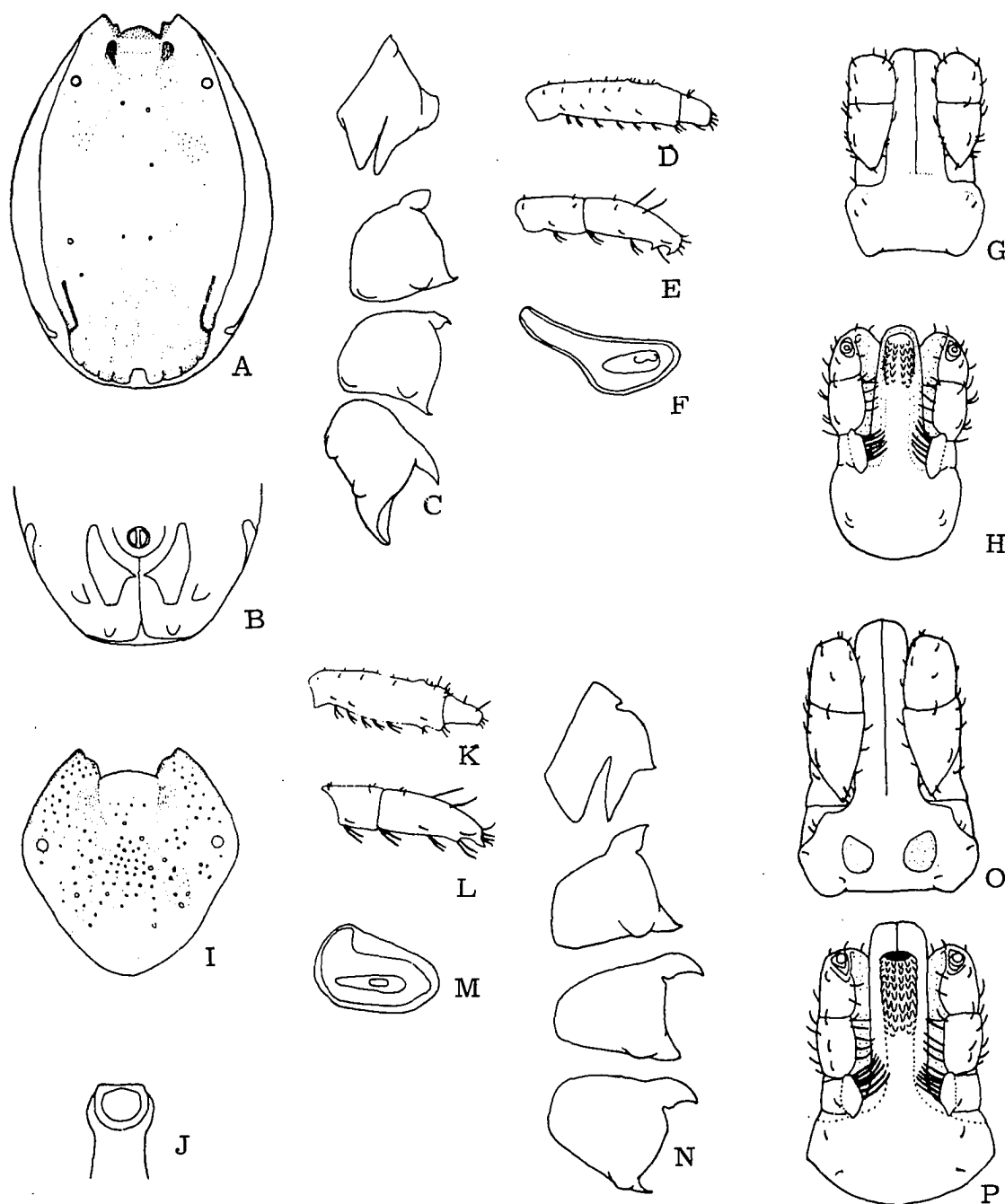
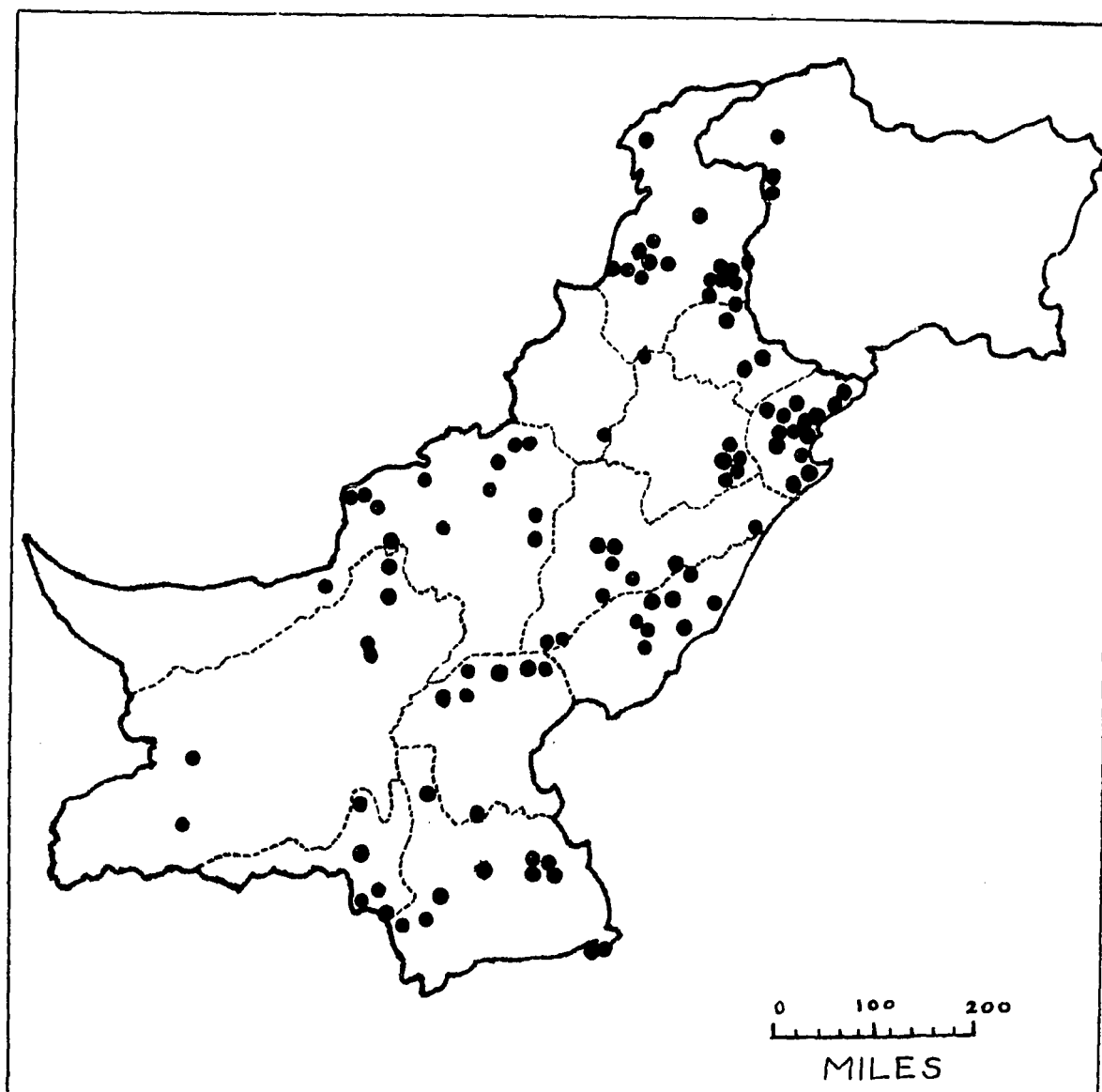


Fig. 20. Hyalomma anatolicum anatolicum Koch, 1844. A-H, male: A-scutum; B-adanal, subanal and accessory shields; C-coxae I-IV; D-tarsus I; E-tarsus IV; F-spiracular plate; G-capitulum, dorsal view; H-capitulum, ventral view. I-P, female: I-scutum, J-genital aperture; K-tarsus I; L-tarsus IV; M-spiracular plate; N-coxae I-IV; O-capitulum, dorsal view; P-capitulum, ventral view.



Map XXII. Hyalomma anatolicum anatolicum Koch, 1844  
Geographical distribution — West Pakistan

HYALOMMA ANATOLICUM EXCAVATUM KOCH, 1844

Synonymy

Hyalomma excavatum

Koch, 1844, Arch. Naturgesch., 10 (1): 222.

Delpy, 1949, Ann. Parasitol. Humaine et Comp., 24 (5-6):  
464-494.

Feldman-Muhsam, 1954, Bull. Res. Counc. Israel, 4 (2): 155-  
159.

Hoogstraal, 1956, African Ixodoidea, Vol. I, Ticks of the Sudan:  
435-451, 878-879, 884-887.

Anastos, 1957, U. S. Pub. Health Serv. Publ. No. 548: 149.

Nagar, 1962, Ent. Bull. (India), (3): 58-61.

Hyalomma anatolicum

Schulze and Schlottke, 1929, S. B. Ges. Naturf. Rostock, ser. 3,  
(2): 32-46. (Reprint published 1929, journal published 1930).

Hyalomma anatolicum excavatum

Pomerantsev, 1946, Opred. Faune SSSR Zool. Muz. Akad. Nauk,  
Leningrad, 26: 24, 27.

Pomerantsev, 1950, Fauna of the USSR, 4 (2): 214.

Hoogstraal and Kaiser, 1959, Ann. Ent. Soc. Amer., 52 (3):  
243-261.

Kaiser and Hoogstraal, 1963, J. Parasit., 49 (1): 130-139.



Hyalomma anatolicum anatolicum

Kratz, 1940, Zeitschr. Parasitenk., 11 (4): 510-562.

Hosts, Distribution and Biology

In West Pakistan adults of Hyalomma anatolicum excavatum have been collected off camels, cattle and sheep. Elsewhere frequent collections have been made from goats and horses, and occasionally from buffaloes, donkeys, mules, man, dogs and antelopes.

In contrast to H. a. anatolicum, immature stages of H. a. excavatum have been collected from numerous species of small mammals. Hoogstraal and Kaiser list the following hosts for nymphs: Paraechinus dorsalis dorsalis, Hemiechinus auritus libycus, Hemiechinus auritus metwallyi, Lepus capensis rothschildi, Jaculus jaculus jaculus, Acomys russatus, Gerbillus gerbillus gerbillus, Meriones crassus crassus, Meriones crassus pallidus and Psammomys obesus obesus.

Several workers have noted that while H. a. excavatum has a wide geographical range its general distribution is spotty and irregular. This appears to be the situation in West Pakistan. Only five collections were made in West Pakistan as compared to over 600 for H. a. anatolicum. H. a. excavatum was collected near Turbat in Kalat Division, and from Gulistan and Hindubagh in Quetta Division. Elsewhere this subspecies has been found in a broad belt extending from North Africa through the Near and Middle East, Greece, Iran, Afghanistan and the Soviet Union.

The following paragraph is taken from Hoogstraal and Kaiser (1959):

. . . 27 days are required for hatching of eggs held in humidified tubes at Cairo summer room temperature. Of 292 larvae secured from a single egg batch, 151 detached from the rabbit host after 4 days of feeding and molted to nymphs 5 days later (three-host type of life cycle); they were then preserved. A slightly smaller number of larvae, 141, underwent a two-host type of life cycle, remaining on the same host, feeding, molting to nymphs, feeding again, and then detaching from 13 to 17 days after having been placed on the host as unfed larvae. These individuals molted to 76 males and 65 females 14 or 15 days after having detached as engorged nymphs. Assuming the prefeeding period of newly hatched larvae to be 4 days, 58 to 63 days are necessary to complete the two-host cycle from oviposition to appearance of adults under conditions described above.

#### Disease Relationship

The taxonomic confusion attending this subspecies makes suspect many older reports in the literature. Hoogstraal holds that the following Soviet work refers to H. a. excavatum: (1) Both transmission by bite and transovarial transmission of the virus of Russian spring-summer encephalitis, (2) Transovarial transmission of Japanese (mosquito-borne) encephalitis, and (3) The persistence for many months of infection in ticks infected with Russian (mosquito-borne) encephalitis (Hoogstraal and Kaiser, 1959).

#### Description - Male (Fig. 21, A-H)

1. Body. Tannish brown to reddish brown. Seven specimens,

length 4.8 mm - 5.5 mm, average 5.2 mm; width 2.7 mm - 3.2 mm, average 2.9 mm.

2. Scutum. Dark reddish brown, elongate oval in shape with bluntly rounded posterior margin. Length 3.9 mm - 4.5 mm, average 4.3 mm; width 2.4 mm - 2.8 mm, average 2.6 mm. Cervical grooves originate as deep pits, rapidly broaden, become shallow and terminate in the anterior half of the scutum. Lateral grooves short and distinct. Caudal region depressed. Posteromedian groove narrow and distinct, separated from parma by a series of elevated ridges. Paramedian grooves indistinct. Caudal depression bounded laterally by a pair of raised ridges which extend to the posterior margin of the scutum. Punctations large and scattered, mainly in lateral scapular and antero-median regions; numerous small punctations in caudal depression. Eyes small, round and deeply socketed.

3. Venter. Reddish brown. Genital aperture between coxae II. Adanal shields heavily chitinized with rectangular posterior margins, outer margin somewhat convex. Subanal shields heavily chitinized and stronger than those of H. a. anatolicum. Spiracular plates comma-shaped with long, thin dorsal projections.

4. Legs. Long, strong and pale brown (some specimens have pale yellowish brown bands on the distal portion of each segment). Coxae similar to those of H. a. anatolicum.

5. Capitulum. Average length 1.1 mm, average width 0.7 mm. Basis capituli dorsally with several punctations. Posterior margin of

basis concave and angular, cornua minute.

6. Hypostome. Average length 0.7 mm. Tip bluntly rounded, dentition 3/3, teeth moderate.

#### Description - Female (Fig. 21, I-P)

1. Body. Brown to reddish brown. Six specimens, length 6.0 mm (unengorged) - 10.3 mm (partially engorged), width 3.6 mm (unengorged) - 6.0 mm (partially engorged).

2. Scutum. Reddish brown. Length 2.2 mm - 2.5 mm, average 2.4 mm; 2.0 mm - 2.5 mm, average 2.3 mm. Scutum cordiform with irregular posterior margin. Cervical grooves commencing as deep pits, but extending as broad shallow depressions to the posterolateral margins of the scutum. Punctations variable and mainly limited to the scapular regions. Eyes prominent, circular and deeply socketed.

3. Venter. Brown, with numerous setae. Genital aperture between coxae II. Operculum knoblike, circular to widely triangular and bulging in profile. Spiracular plates ovate with short thick dorsal projections.

4. Legs. As in the male.

5. Capitulum. Length 1.2 mm - 1.4 mm, average 1.3 mm; width 0.8 mm - 1.0 mm, average 0.9 mm. Palps strong. Posterior margin of basis capituli faintly concave and angular, cornua absent. Porose areas elongate oval and separated by a ridge extending to the posterior margin of the basis.

6. Hypostome. Average length 0.9 mm, in other respects similar to that of the male.

#### Remarks

H. a. excavatum is uncommon in West Pakistan and has not been collected East of the Indus. As was previously stated, the report of H. excavatum from India (Nagar, 1962) probably refers to H. a. anatolicum.

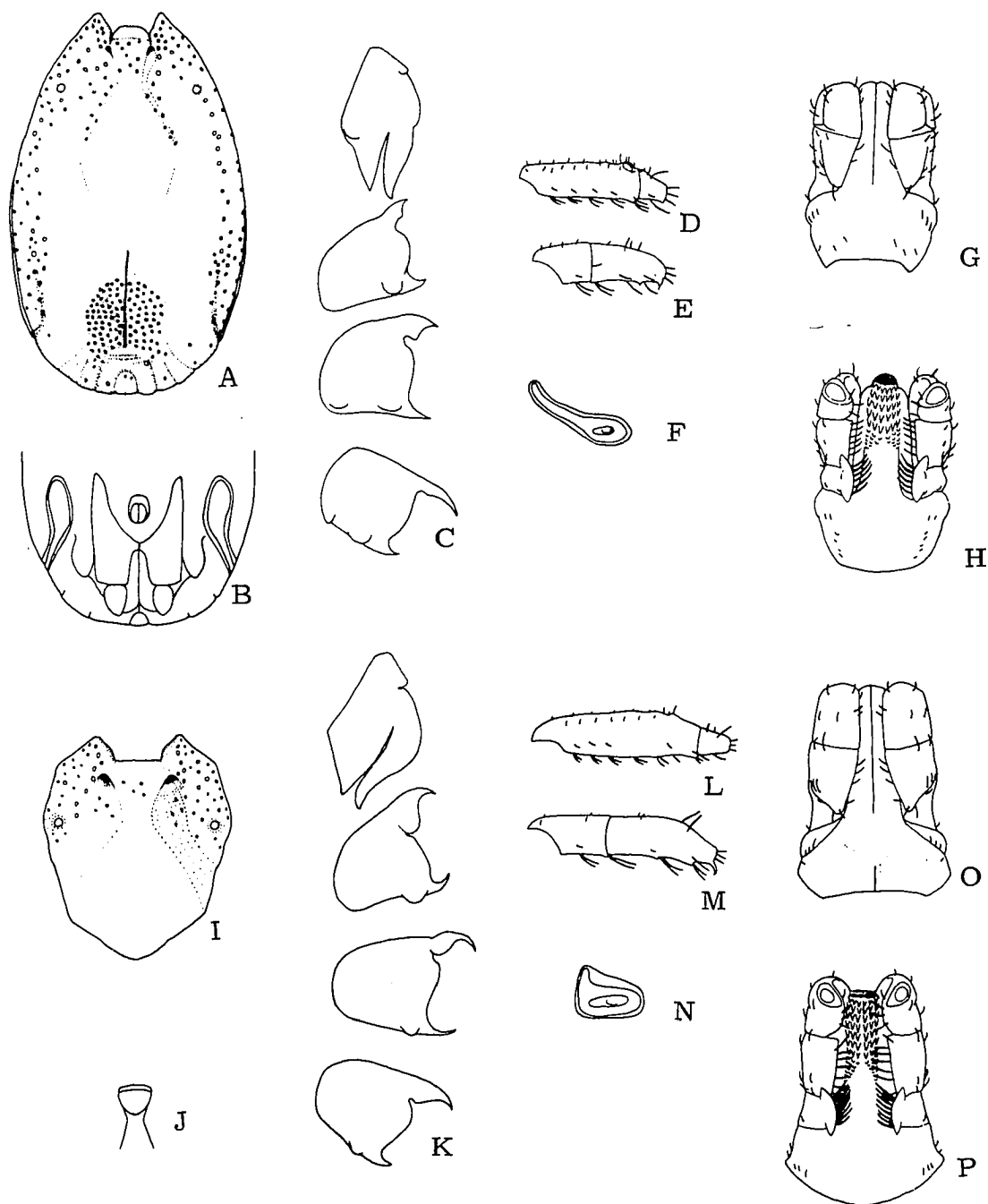
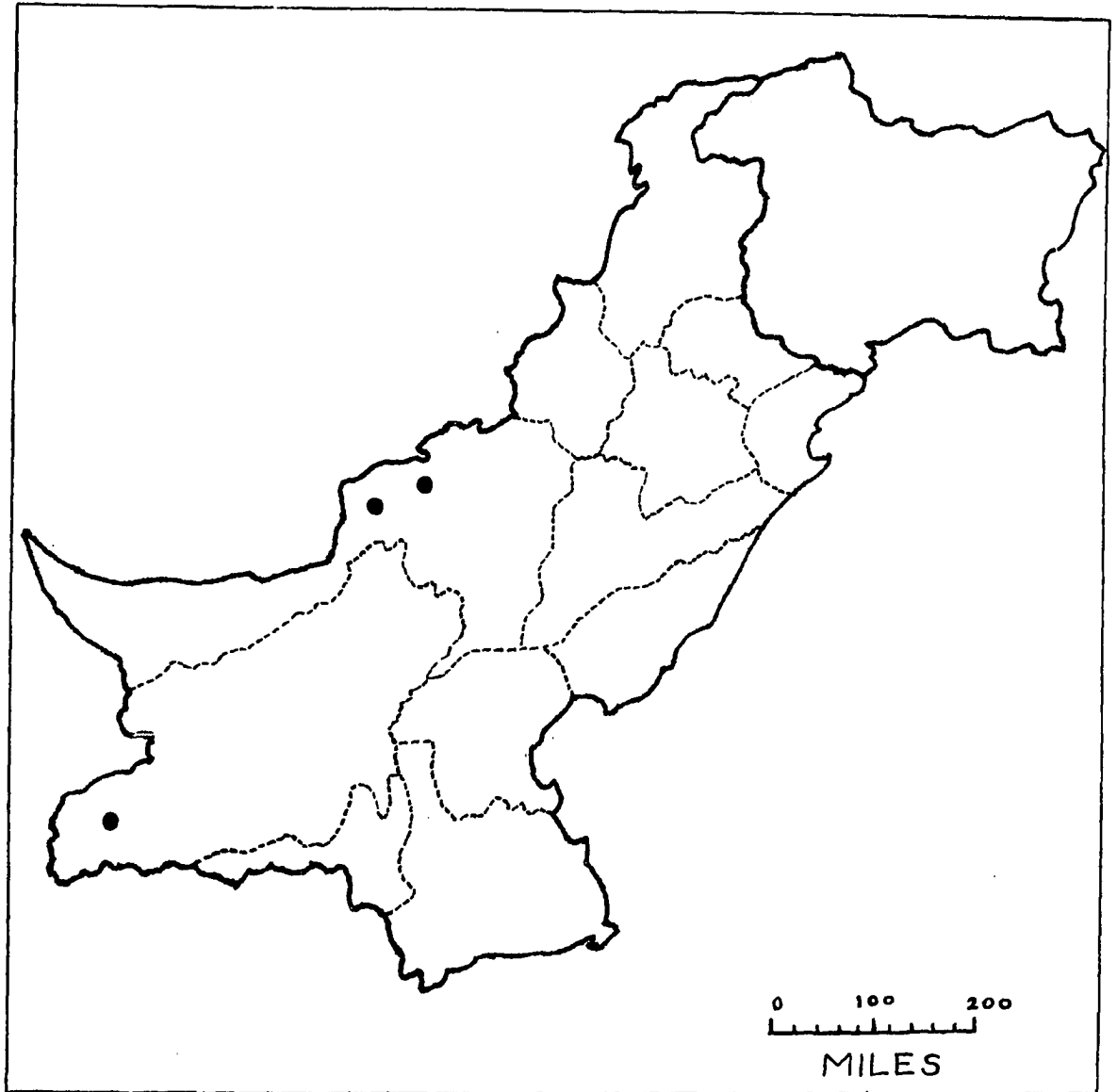


Fig. 21. Hyalomma anatolicum excavatum Koch, 1844. A-H, male: A-scutum; B-adanal, subanal and accessory shields; C-coxae I-IV; D-tarsus I; E-tarsus IV; F-spiracular plate; G-capitulum, dorsal view; H-capitulum, ventral view. I-P, female: I-scutum; J-genital aperture; K-coxae I-IV; L-tarsus I; M-tarsus IV; N-spiracular plate; O-capitulum, dorsal view; P-capitulum, ventral view.



Map XXIII. Hyalomma anatolicum excavatum Koch, 1844  
Geographical distribution – West Pakistan

HYALOMMA ASIATICUM ASIATICUM SCHULZE and SCHLOTTKE, 1929

Synonymy

Hyalomma dromedarii asiaticum

Schulze and Schlottke, 1929, S. B. Ges. Naturf. Rostock, ser. 3,  
(2): 32-46. (Reprint published 1929, journal published  
1930).

Hyalomma asiaticum

Schulze, 1935, Wiss. Ergebn. neiderl. Exped. Karakorum, 1:  
178-186.

Hyalomma asiaticum asiaticum

Pomerantsev, 1946, Opred. Faune SSSR Zool. Muz. Akad. Nauk,  
Leningrad, 26: 1-28.

Pomerantsev, 1950, Fauna of the USSR, 4 (2): 182, 183.

Kaiser and Hoogstraal, 1963, J. Parasit., 49 (1): 130-139.

Hyalomma dromedarii

Hoogstraal, 1956, African Ixodoidea, Vol. I, Ticks of the Sudan:  
424.

Anastos, 1957, U. S. Pub. Health Serv. Publ. No. 548: 143.

Hosts, Distribution and Biology

In West Pakistan adults of Hyalomma asiaticum asiaticum were



collected from camels, cattle, sheep, goats, and hedgehog (Hemiechinus megalotis).

Pomerantsev (1950) lists the following hosts in the Soviet Union: "mainly camels, less frequently cattle, horses, sheep and very rarely goats, donkeys, swine, wild boar, hedgehog (Hemiechinus albulus turanicus), hare and man. Larvae were found on hedgehogs (H. albulus); nymphs on hedgehogs, marmots and sand rats."

H. a. asiaticum has been reported from Iran, Iraq and Afghanistan. In the USSR it is found in Kazakhstan, Turkmenia, Uzbekistan and Tadzhikistan. In West Pakistan its range appears to be limited to the dryer western and northwestern regions. Collections were made near Warsak in Peshawar Division; Kalat City and area in Kalat Division; and Chaman, Hindubagh, Changai, Hanna, Urrak and Ft. Sandeman in Quetta Division.

Pomerantsev (1950) reports that adults of Hyalomma asiaticum asiaticum have been collected from March to October. Immature stages were found on small animals from March to August. In West Pakistan adults were collected from March to June.

#### Disease Relationship

This subspecies has been reported as attacking both man and domestic animals, and Soviet investigators have infected it with Coxiella burneti and observed that it retained the rickettsia transstadially, and passed it on transovarially to its progeny. Hyalomma asiaticum

(subspecies not stated) has been reported as a vector of tick-borne exanthematous fever in the Soviet Union by Proreshnaya and Rapoport (1963).

Description - Male (Fig. 22, A-H)

1. Body. Pale yellowish brown to dark brown. Ten specimens, length 5.2 mm - 5.9 mm, average 5.6 mm; width 2.7 mm - 3.3 mm, average 3.1 mm.

2. Scutum. Ovate. Length 4.4 mm - 4.9 mm, average 4.6 mm; width 2.6 mm - 2.9 mm, average 2.7 mm. Cervical grooves long, wide and deep, extending to the scutal midline and in some specimens appearing to fuse with the paramedian grooves. The posteromedian groove is long, extending from the scutal midline to a point just short of the parma. The lateral grooves are short and the caudal area is depressed. Punctations are large and limited mainly to the lateral, scapular and anteromedian regions. Eyes are circular and socketed.

3. Venter. Dull yellow. Genital aperture between coxae II. Adanal shields large, straight with parallel inner margins. Subanal shields usually outside lateral axis of adanals (see "Remarks"). Subanal shields with narrow bluntly rounded tips projecting out posteriorly from body surface and usually visible dorsally. Spiracular plates long and comma-shaped with long thin dorsal projection.

4. Legs. Long and strong. Coxa I with double spurs typical of the subgenus, coxae II - IV with single small outer spurs.

5. Capitulum. Average length 1.1 mm, average width 0.7 mm. Palps strong. Basis capituli punctate dorsally; posterior margin concave, angular, with weak cornua.

6. Hypostome. Average length 0.7 mm, bluntly rounded, dentition 3/3, teeth moderate.

#### Description - Female (Fig. 22, I-P)

1. Body. Yellow to deep brown. Eight specimens, length 5.4 mm (unengorged) - 10.5 mm (engorged); width 2.8 mm (unengorged) - 5.4 mm (engorged).

2. Scutum. Cordiform, with lateral bulges in region of eyes. Length 1.9 mm - 2.4 mm, average 2.2 mm; width 1.9 mm - 2.4 mm, average 2.1 mm. Cervical grooves long and wide, extending to the posterolateral margins of the scutum. Numerous small punctations in scapular regions, large punctations in cervical grooves, occasional scattered punctations in anteromedian field. Eyes prominent, circular and socketed.

3. Venter. Genital aperture between coxae II. Operculum longitudinally oval, bulging in profile, not bordered by an elevated fold. Spiracular plates subovate with short dorsal projections.

4. Legs. Long, more slender than those of male. Coxae similar to those of male.

5. Capitulum. Length 1.1 mm - 1.4 mm, average 1.2 mm; width 0.8 mm - 1.0 mm, average 0.9 mm. Basis capituli subhexagon-

al, only slightly concave on posterior margin. Cornua absent. Dorsal depressions on basis small and ovate.

6. Hypostome. Average length 0.9 mm. Tip bluntly rounded, dentition 3/3, teeth moderate.

#### Remarks

Pomerantsev (1950) lists the size range of males as 6 - 7 mm. Kaiser and Hoogstraal (1963) point out that males from Afghanistan are smaller. Males from West Pakistan correspond more closely to the Afghan populations. Kaiser and Hoogstraal also state that the subanal shields were situated on the median axis of the adanals (except in greatly engorged individuals). While occasional West Pakistani males show this positioning, the great majority of specimens have subanals situated outside the median axis.

Males of this subspecies are easily identified by the shape and sharply projecting angle of the subanal shields.

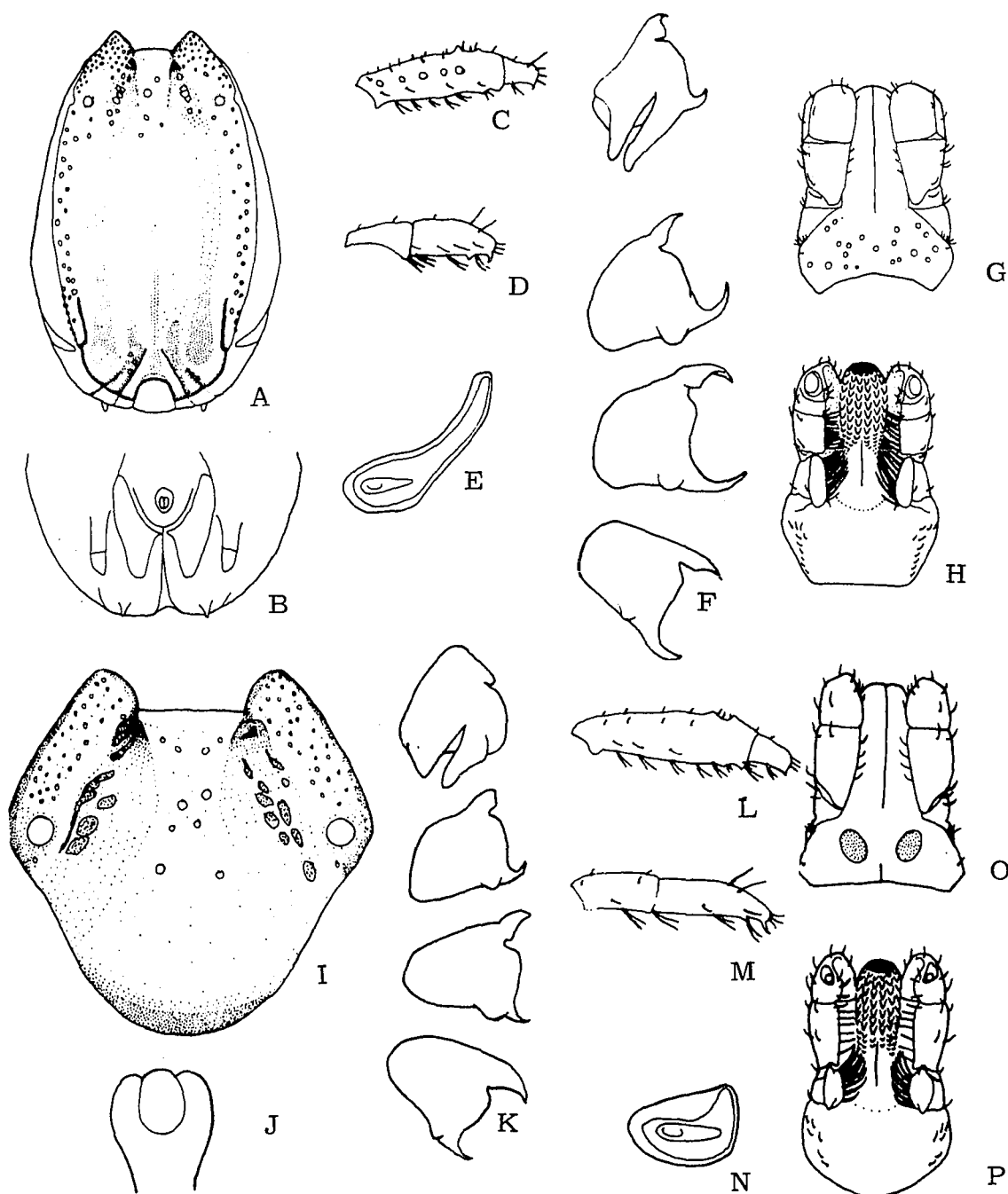
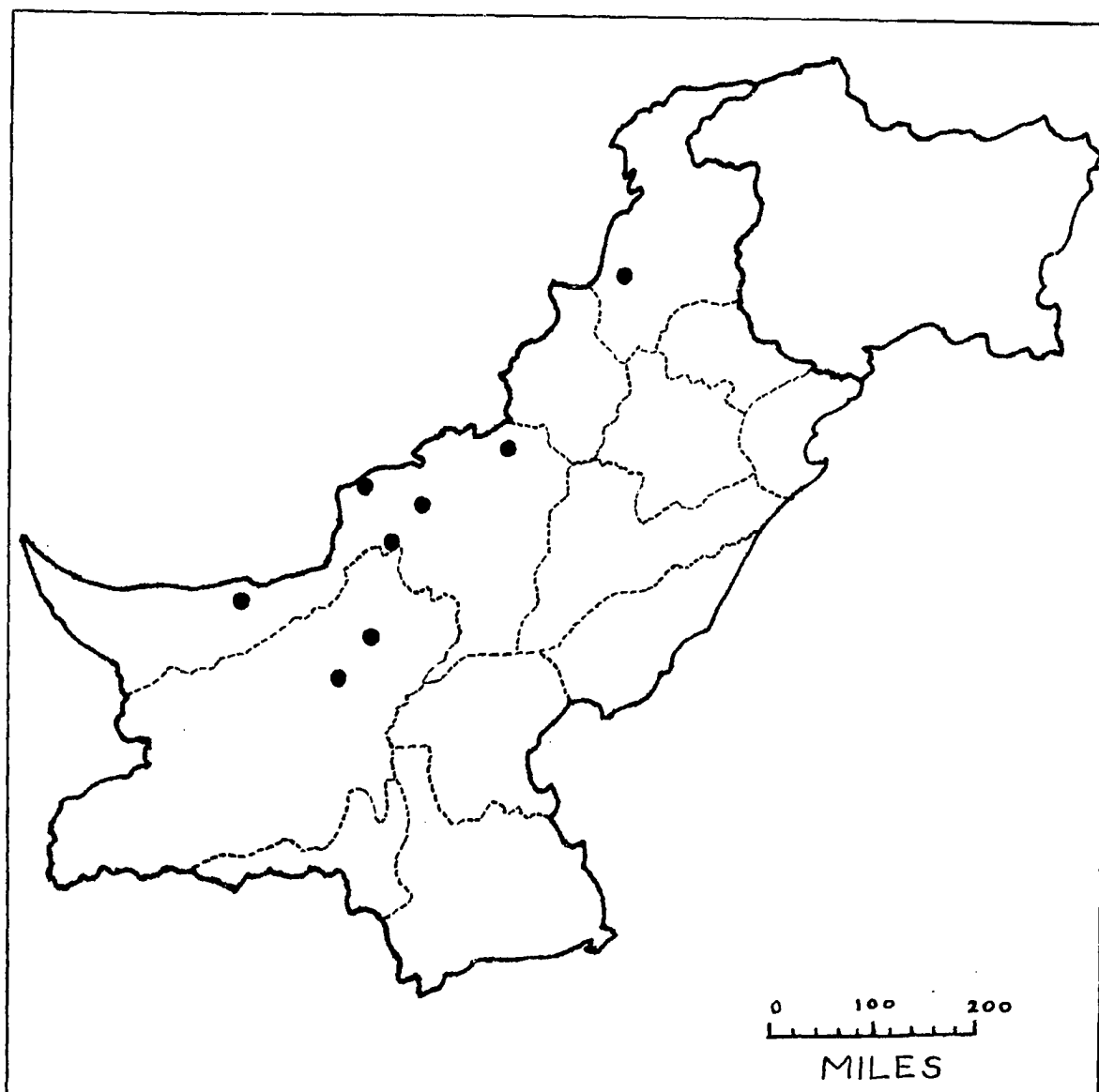


Fig. 22. Hyalomma asiaticum asiaticum Schulze and Schlottke, 1929. A-H, male: A-scutum; B-adanal, subanal and accessory shields; C-tarsus I; D-tarsus IV; E-spiracular plate; F-coxae I-IV; G-capitulum, dorsal view; H-capitulum, ventral view. I-P, female: I-scutum; J-genital aperture; K-coxae I-IV; L-tarsus I; M-tarsus IV; N-spiracular plate; O-capitulum, dorsal view; P-capitulum, ventral view.



Map XXIV. *Hyalomma asiaticum asiaticum* Schulze and Schlottke, 1929  
Geographical distribution — West Pakistan

HYALOMMA DETRITUM SCHULZE, 1919

Synonymy

Hyalomma detritum

Schulze, 1919, S. B. Ges. Naturf. Fr., Berlin, 5: 189-196.

Pomerantsev, 1950, Fauna of the USSR, 4 (2): 186-188.

Hoogstraal, 1956, African Ixodoidea, Vol. I, Ticks of the Sudan:  
403-419.

Anastos, 1957, U. S. Pub. Health Serv. Publ. No. 548: 132-142.

Nagar, 1962, Ent. Bull. (India), (3): 58-61.

Kaiser and Hoogstraal, 1963, J. Parasit., 49 (1): 130-139.

Kaiser and Hoogstraal, 1964, Acarologia, 6 (2): 257-286.

Hyalomma aegyptium subsp. ferozdini nov.

Sharif, 1928, Rec. Indian Mus., 30 (3): 310, 311.

Hosts, Distribution and Biology

Pakistani populations of Hyalomma detritum have been found only on domestic animals. These were: Bubalus bubalis (31 collections), Bos indicus (23 collections), Camelus dromedarius ( 8 collections), Capra hircus (3 collections), and Equus caballus (1 collection).

In West Pakistan adults of H. detritum have been collected from March through September. This species is widely distributed both

ecologically and geographically, and 70 collections were made from every division except Hyderabad and Dera Ismail Khan.

Elsewhere H. detritum has been reported from India, Afghanistan, USSR, Iran, China, Syria and North Africa.

The following sections are quoted from Pomerantsev (1950):

. . . Development occurs along the two-host type. Parasitism of adults occurs in the Summer. Adults appear in the middle of May, reach maximum in July and cease to be seen in September. Larvae and nymphs appear from August and September on. Larvae are capable of attacking livestock in barns on warm days during the Winter. . . Satiated nymphs drop off the host in the Fall. Part of the nymphs overwinter on livestock and leave it only in the Spring after feeding. In nature, nymphs feed on and drop off the host in the fall, in the lab. throughout October, December, January, February, March and April, all molt within one season: from the end of May to the beginning of July (en masse in June). In this way the length of the pause in development of satiated nymphs can fluctuate depending on the time of feeding: nymphs that began their development as larvae in October - 8.5 months, nymphs that fed as larvae in April - 2 months. The female can starve for 6 - 7 months; she feeds in May - August for 7 - 27 days, 11 days on the average. Oviposition begins within 6 - 31 days after leaving the host; number of eggs - 5000 - 7000. Larvae appear on about 25 - 60th day; they can starve for 7 - 8 months; after breaking from the egg the larvae are capable of attaching to host within 7 days. They feed for about 11 days; nymphs suck blood in August - October for about 11 days; they overwinter in cracks in walls - from October to May and molt after hibernation in May, June and July. Hungry adults leave the places of molting in night time and search for a host... The developmental cycle of H. detritum is one year. Winter diapause is observed in a satiated nymph whose development in the yearly cycle of the species occurs away from the host and during Winter... Satiated nymphs were found in Central Asia under piles of manure in the walls of barns ... and under stones in Algeria. Molt of nymphs into adults can occur in covered houses which aids to mass development of the tick and the origin of epizooty of theiriosis when livestock is kept in one place....



H. detritum varies mainly in size, reaching the greatest size in Central Asia and decreasing gradually westward. As far as the material from the USSR allows us to judge these changes are practically unobservable due to individual variation. The shades of color of legs and other parts of the body lie within the boundaries of the variations and do not provide a basis for separation of geographical groups....

Hosts of adults: cattle, horse, swine, camel, sheep, buffalo, zebu, donkey, hare. Nymphs: cattle and horse.

### Disease Relationship

H. detritum is considered by Soviet workers to be a possible vector of the virus of Uzbekistan hemorrhagic fever. It is a natural reservoir of Q fever and retains this organism both transstadially and transovarially.

H. detritum transmits Theileria dispar and Theileria annulata to cattle, and Nuttallia equi to horses.

### Description - Male (Fig. 23, A-H)

1. Body. Dark brown. Ten specimens, length 4.4 mm - 5.5 mm, average 5.1 mm; width 2.4 mm - 3.2 mm, average 3.0 mm.

2. Scutum. Dark reddish brown, shape subovate. Length 3.5 mm - 4.5 mm, average 4.2 mm; width 2.2 mm - 2.9 mm, average 2.6 mm. Cervical grooves short and shallow, extending slightly past eyes. Lateral grooves long and distinct, approaching region of eyes. Posteromedian groove distinct, extending from a prominent parma (usually white) to middle third of scutum. Paramedian grooves less

distinct, approximately half the length of the posteromedian groove. Punctations large and shallow, restricted mainly to regions between posteromedian and paramedian grooves. Numerous smaller punctations present in scapular regions. Eyes circular and deeply socketed.

3. Venter. Pale brown. Genital aperture between coxae II. Adanal shields moderate in size, posteriorly rectangular, with prominent medially directed spurs on interior border below anal region. Accessory anal and subanal spurs prominent, subanals situated on the midline of the axis of the adanals. Spiracular plate comma-shaped with long dorsal projection.

4. Legs. Pale brown and strong. Leg segments with pale dorsal stripe. Coxa I with typical subgeneric double spur. Coxae II - IV each with weak rounded outer spur. Coxa IV sometimes with minute inner spur.

5. Capitulum. Length 1.0 mm - 1.2 mm, average 1.1 mm; width 0.6 mm - 0.8 mm, average 0.7 mm. Basis capituli dorsally with several punctations. Posterior margin of basis concave and angular. Cornua minute.

6. Hypostome. Average length 0.7 mm. Tip bluntly rounded, dentition 3/3, teeth moderate.

#### Description - Female (Fig. 23, I-P)

1. Body. Pale yellow to dark brown. Ten specimens, length 5.5 mm (unengorged) - 17.0 mm (engorged); width 3.3 mm (unengorged)

- 11.0 mm (engorged).

2. Scutum. Dark brown and cordiform, posterior border bluntly rounded and widest in region of eyes. Length 2.00 mm - 2.5 mm, average 2.2 mm; width 1.9 mm - 2.2 mm, average 2.1 mm. Cervical grooves start as deep pits, rapidly widen and become shallow, and extend to the posterolateral borders of the scutum. Punctations are few, large, shallow and irregularly scattered over the smooth shiny surface. Eyes are prominent, circular and deeply socketed.

3. Venter. Pale yellowish brown. Genital aperture between coxae II. Operculum broadly triangular with slightly convex sides. Posterior tip rounded rather than pointed. Profile gradually depressed posteriorly. Spiracular plates subovate with short thick dorsal projections.

4. Legs. As in the male.

5. Capitulum. Length 1.2 mm - 1.4 mm, average 1.3 mm; width 0.8 mm - 0.9 mm, average 0.9 mm. Palps long and angular. Basis capituli indented laterally. Posterior margin slightly concave, cornua absent. Porose areas large and ovate, separated posteriorly by a broad ridge.

6. Hypostome. Average length 0.9 mm. Tip bluntly rounded and indented at center, dentition 3/3, teeth moderate.

#### Remarks

Several workers have placed Hyalomma scupense in synonymy

with H. detritum. Recent investigations indicate that they are two distinct species. Thus several review papers citing the distribution of H. detritum in southern Europe, etc., and its role in the transmission of Pasturella pestis and P. tularensis actually refer to H. scupense.

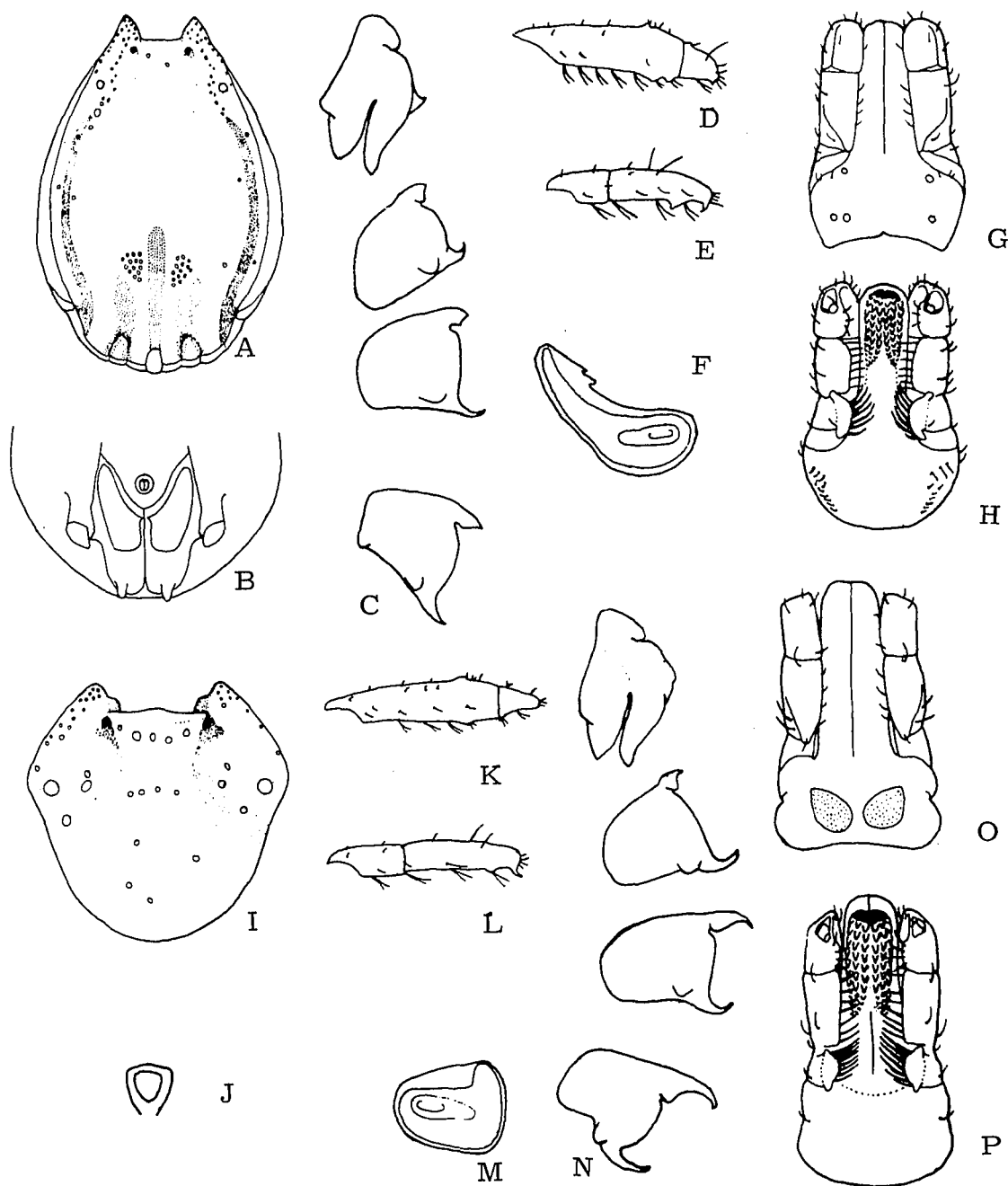
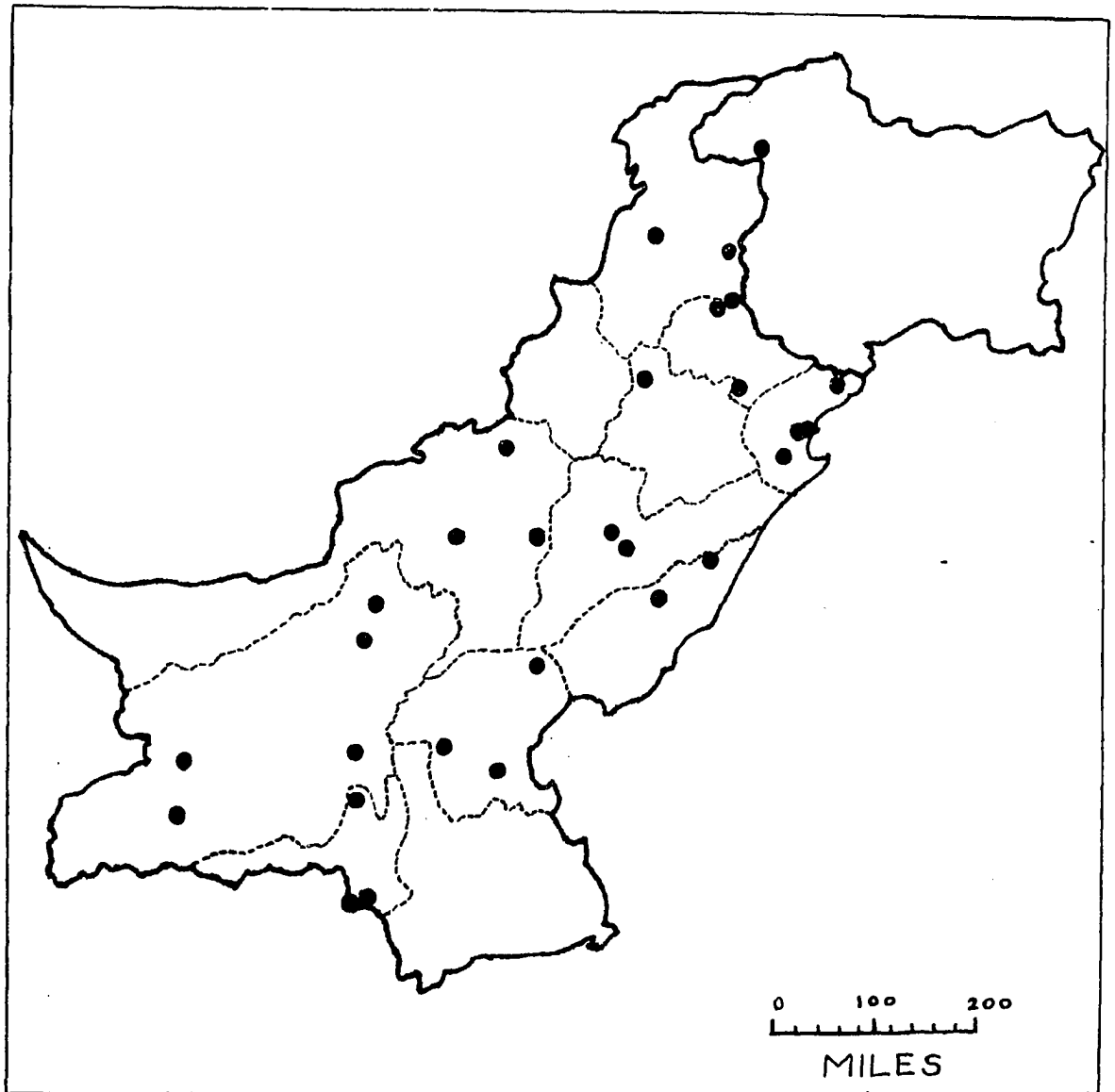


Fig. 23. Hyalomma detritum Schulze, 1919. A-H, male: A-scutum; B-adanal, subanal and accessory shields; C-coxae I-IV; D-tarsus I; E-tarsus IV; F-spiracular plate; G-capitulum, dorsal view; H-capitulum, ventral view. I-P, female: I-scutum; J-genital aperture; K-tarsus I; L-tarsus IV; M-spiracular plate; N-coxae I-IV; O-capitulum, dorsal view; P-capitulum, ventral view.



Map XXV. Hyalomma detritum Schulze, 1919  
Geographical distribution — West Pakistan

HYALOMMA DROMEDARII KOCH, 1844

Synonymy

Hyalomma dromedarii

Koch, 1844, Arch. Naturgesch., 10 (1): 220.

Pomerantsev, 1950, Fauna of the USSR, 4 (2): 197-200.

Hoogstraal, 1956, African Ixodoidea, Vol. I, Ticks of the Sudan:  
420-434.

Nagar, 1962, Ent. Bull. (India), (3): 58-61.

Kaiser and Hoogstraal, 1964, Acarologia, 6 (2): 274, 275.

Hyalomma aegyptium subsp. dromedarii

Sharif, 1928, Rec. Indian Mus., 30 (3): 306, 307.

Hosts, Distribution and Biology

Hyalomma dromedarii is considered to be a desert-adapted tick whose immature stages are commonly found on burrowing mammals, and whose adult stage is usually found on camels and cattle. Anastos (1957) lists the following hosts from Soviet literature. Adults: camels, cattle, horses, sheep, goats, donkeys, swine, men, hedgehogs, hares and wild boar. Nymphs: camel, cattle, hedgehog, marmot and Pal-lasiomys. Larvae: hedgehog. Hoogstraal (1956) reports the collection of larvae and nymphs in Yemen from the following hosts: hare, rat, and gerbil. In Egypt nymphs have been reported from hedgehogs,

hares, rodents and lizards.

In West Pakistan H. dromedarii is an extremely common tick. Over 2,000 adult specimens were found in 286 collections. H. dromedarii is found in every division and in each month of the year. The hosts (of adults) in order of frequency are as follows: buffalo (90 collections), cattle (81 collections), camels (80 collections), sheep (13 collections), goats (nine collections), horses (four collections), Gazella gazella bennetti (one collection), Vulpes benegalensis (one collection) and Sus scrofa cristatus (one collection).

Ecologically H. dromedarii has been found under a wide range of conditions, ranging from true desert, through dry salt flats and steppe lands to well irrigated canal regions. While it has been found at 7,000 feet elevation, it is not common in the northern hill regions of West Pakistan. Elsewhere in Pakistan it appears to follow the distribution of its major hosts. This species has been reported from the Soviet Union, northwestern India, Afghanistan, Arabia, the Near and Middle East, and in several African nations below the Sahara.

Hoogstraal (1956) and Anastos (1957) have summarized the findings of Eastern and Western workers on the biology of Hyalomma dromedarii. Opinion is divided on whether H. dromedarii is a one, two or three host tick. Hoogstraal maintains that it is normally a two host tick with the change in hosts occurring after the nymphal-adult molt, but several workers have experimentally reared this tick through its cycle on a single host, on two hosts, or three hosts. The life cycle



has been reported as ranging from 93 to over 280 days, and two generations a year may occur in nature.

### Disease Relationship

H. dromedarii is a vector of Q fever (Coxiella burneti). Philip (1963) cites reports that C. burneti was isolated from H. dromedarii taken from a camel that had been imported into Japan from Pakistan.

Anastos (1957) cites Soviet experiments in which this tick fed on rodents infected with spring-summer encephalitis, acquired the infection, retained the virus for 15 months, and transovarially passed the infection through two succeeding generations. Transmission of Japanese (mosquito-borne) encephalitis to a second generation was also demonstrated. Hoogstraal (1956) adds to the above the experimental transmission of autumn encephalitis (mosquito-borne), from the Soviet Maritime Province.

H. dromedarii also transmits Theileria spp. to cattle and camels. Neitz (1956) lists H. dromedarii as a vector of the following organisms: Babesia caballi, Theileria parva and Gonderia annulata.

### Description - Male (Fig. 24, A-H)

1. Body. Yellowish brown to deep reddish brown. Fourteen specimens, length 4.5 mm - 6.7 mm, average 5.8 mm; width 3.2 mm - 5.7 mm, average 4.1 mm. The great width of engorged specimens is due to the lateral stretching of the integument.

2. Scutum. Elongate, subovate. Length 3.8 mm - 5.8 mm, average 4.8 mm; width 2.6 mm - 3.8 mm, average 3.2 mm. Cervical grooves long and shallow, posteriorly approaching a pair of subcircular depressions located on the lateral regions of mid-scutum. Lateral grooves short and deep, limited to the posterior third of the scutum. Posteromedian groove extends from mid-scutum to the parma. Paramedian grooves shorter, wider and limited to posterior third of scutum. Punctations large and shallow, limited mainly to lateral margins and scapular areas. Eyes are prominent, circular and deeply socketed.

3. Venter. Pale grayish yellow, shields orange brown. Adanal shields large, curving posteriorly and with a large spur on the inner margin. Subanal shields large, curving, situated exterior to the axis of the adanal shields. Genital aperture between coxae II. Spiracular plates comma-shaped with long, thin dorsal projections.

4. Legs. Long and strong. Coxa I deeply divided into narrow outer spur, and wider inner spur. Coxae III, IV with weak outer spurs. Coxae II-IV may or may not have weak, rudimentary inner spurs or ridges.

5. Capitulum. Length 0.9 mm - 1.2 mm, average 1.1 mm; width 0.7 mm - 0.9 mm, average 0.8 mm. Posterior margin of basis capituli concave. Cornua minute. Palps moderate.

6. Hypostome. Average length 0.7 mm; tip bluntly rounded, dentition 3/3, teeth moderate.

## Description - Female (Fig. 24, I-P)

1. Body. Yellowish brown to deep brown. Sixteen specimens, length 5.6 mm (unengorged) - 20.0 mm (engorged); width 3.3 mm (unengorged) - 11.0 mm (engorged).
2. Scutum. Cordiform, posterior margin bluntly rounded. Length 2.0 mm - 2.4 mm, average 2.2 mm; width 2.0 mm - 2.5 mm, average 2.1 mm. Cervical grooves deep, wide, long, extending to the posterolateral margins of the scutum. Punctations large and shallow, limited mainly to scapular and anteromedian regions. Eyes prominent and circular, sockets deep and extending to lateral margins.
3. Venter. Yellowish brown. Genital aperture between coxae II. Aperture elongate, narrowly triangular. Spiracular plates subovate with short dorsal projections.
4. Legs. Pale yellow, darker dorsally; long, more slender than those of the male. Coxae I - IV similar to those of the male.
5. Capitulum. Length 1.1 mm - 1.5 mm, average 1.3 mm; width 0.8 mm - 1.0 mm, average 0.9 mm. Porose areas of basis capituli ovate deep and separated by a high ridge. Posterior margin of basis slightly concave, cornua minute.
6. Hypostome. Average length 0.8 mm. Tip bluntly rounded, dentition 3/3, teeth moderate.

## Remarks

Small males of this species may resemble H. impeltatum and

H. a. excavatum. They can be distinguished from the former by the shortness of their lateral grooves and from the latter by the position of their subanal shields.

H. dromedarii rarely is found on man, but its demonstrated ability to transmit several pathogens to domestic stock constitutes a serious problem in agricultural regions.

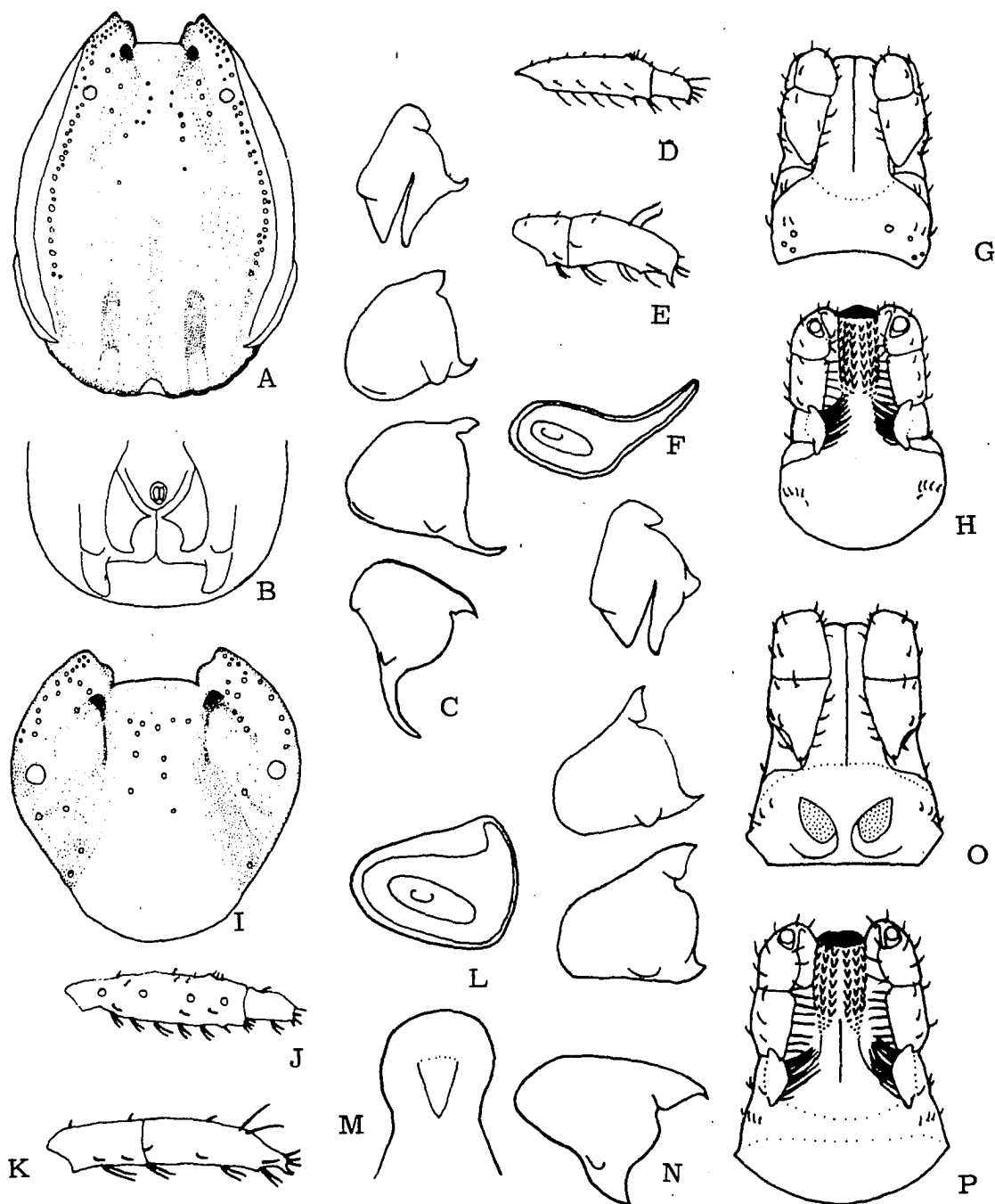
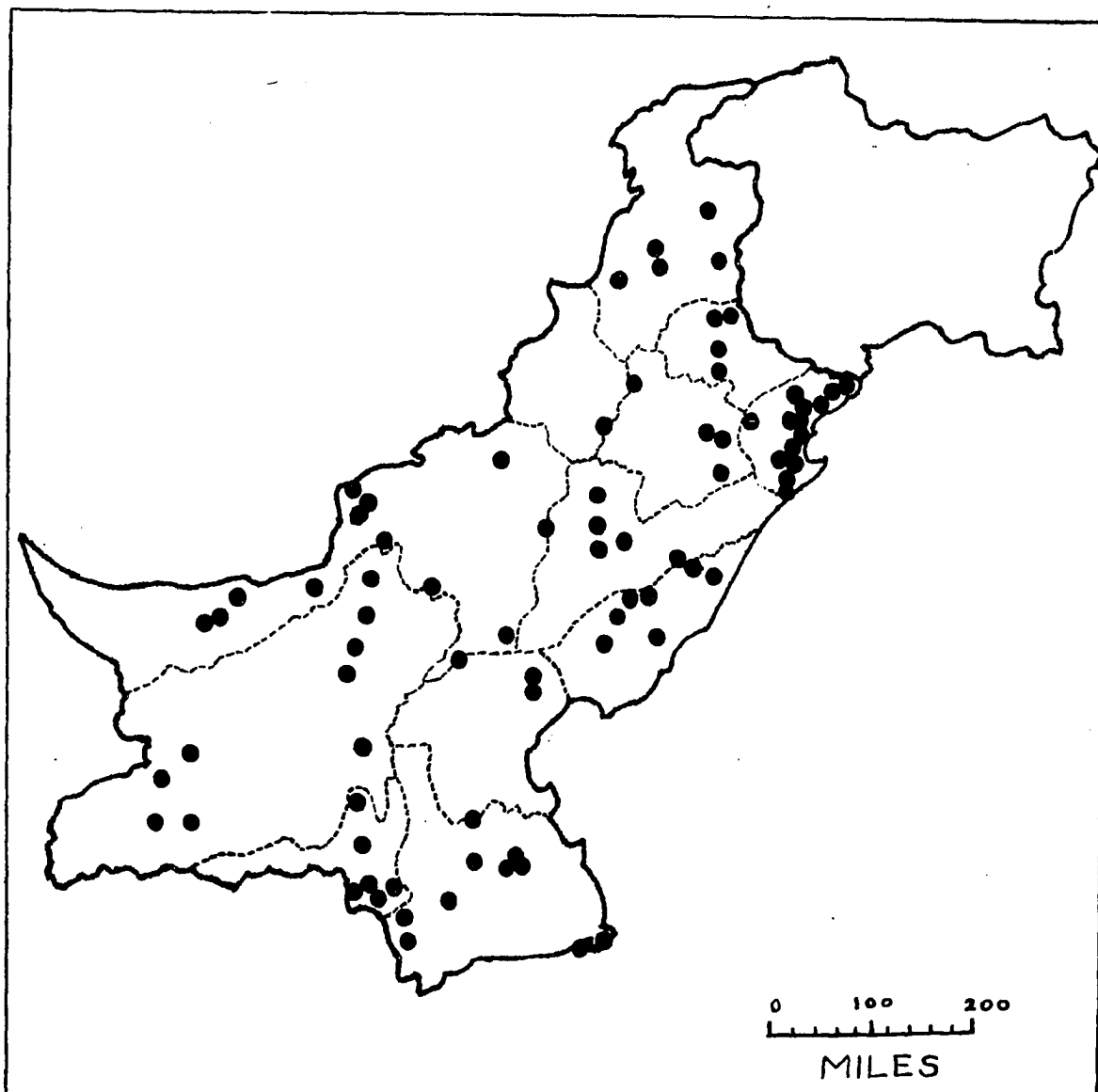


Fig. 24. Hyalomma dromedarii Koch, 1844. A-H, male: A-scutum; B-adanal, subanal and accessory shields; C-coxae I-IV; D-tarsus I; E-tarsus IV; F-spiracular plate; G-capitulum, dorsal view, H-capitulum, ventral view. I-P, female: I-scutum; J-tarsus I; K-tarsus IV; L-spiracular plate; M-genital aperture; N-coxae I-IV; O-capitulum, dorsal view; P-capitulum, ventral view.



Map XXVI. Hyalomma dromedarii Koch, 1844  
Geographical distribution — West Pakistan

HYALOMMA IMPELTATUM SCHULZE and SCHLOTTKE, 1929

Synonymy

Hyalomma savignyi impeltatum

Schulze and Schlottke, 1929, S. B. Ges. Naturf. Rostock, ser. 3,  
(2): 32-46. (Reprint published 1929, journal published  
1930).

Hyalomma impeltatum

Kratz, 1940, Z. Parasitenk., 11 (4): 510-562.

Hoogstraal, 1956, African Ixodoidea, Vol. I, Ticks of the Sudan:  
452-460.

Kaiser and Hoogstraal, 1963, J. Parasit., 49 (1): 130-139.

Hyalomma brumpti

Delpy, 1946, Ann. Parasitol. Humaine et Comp., 21 (5-6): 267-  
293.

Hosts, Distribution and Biology

In West Pakistan one collection (1♂, 1♀) of Hyalomma impeltatum  
was taken from domestic sheep in January, 1963, near Yazman in  
Bahawalpur Division.

In Africa H. impeltatum is a three host tick found mainly in arid  
and semi-arid regions. In Egypt adult stages have been found on dom-

estic animals and man. African wildlife reported infested are: gazelles, wild pig, rhinoceros, wildebeest and caracal. Immature stages have been found on lizards, rodents, hares, birds and man.

H. impeltatum is found in widely scattered foci from Afghanistan, Iran, Iraq, Turkey, Israel and numerous areas in Africa.

### Disease Relationship

Unknown.

### Description - Male (Fig. 25, A-H)

1. Body. Pale light brown. One specimen, length 3.2 mm, width 1.7 mm.
2. Scutum. Ovate, widest at posterior third of scutum. Length 2.6 mm, width 1.7 mm. Cervical grooves shallow and limited to anterior half of scutum. Lateral grooves shallow and partially obscured by medium sized punctations, but extending into anterior half of scutum. Posteromedian groove extending from parma to middle third of scutum. Paramedian grooves present but indistinct. Caudal region depressed and containing many small punctations. Numerous small punctations present on scapular regions. Eyes small, circular and deeply socketed.
3. Venter. Yellowish brown. Genital aperture between coxae II. Adanal shields small, curved and slightly convex on outer borders. Subanal shields rudimentary and only slightly outside the midline of the adanals (unengorged specimen). Spiracular plates comma-shaped with long thin dorsal projections.



4. Legs. Medium sized. Coxa I with double spurs typical of the subgenus, coxae II, III with single small outer spurs, coxa IV with small outer spur and rudimentary inner spur.

5. Capitulum. Length 0.8 mm, width 0.5 mm. Posterior margin of basis capituli concave. Cornua rudimentary.

6. Hypostome. Length 0.5 mm. Tip bluntly rounded, dentition 3/3, teeth moderate.

Description - Female (Fig. 25, I-P)

1. Body. Light brown. One specimen, length 5.6 (partially engorged); width 3.0 mm (partially engorged).

2. Scutum. Cordiform and arced. Length 2.0 mm, width 2.0 mm. Cervical grooves prominent, extending to the posterolateral borders of the scutum. Small punctations numerous in posterior half of scutum. Many large irregular punctations in cervical grooves. Eyes prominent, circular and deeply socketed.

3. Venter. Pale brown to tan. Genital aperture between coxae II. Operculum ovate, bulging and slightly depressed posteriorly. Operculum bordered on each side by a bulging lip, giving the genital area a trilobed appearance. Spiracular plates subovate with short, wide dorsal projections.

4. Legs. As in the male, save that coxa IV lacks a rudimentary inner spur.

5. Capitulum. Length 1.2 mm, width 0.8 mm. Basis capituli

subhexagonal, posterior margin straight, cornua rudimentary. Dorsal depressions ovate and separated by a prominent wide ridge.

6. Hypostome. Length 0.8 mm, bluntly rounded, small notch at tip. Dentition 3/3, teeth moderate.

#### Remarks

Hoogstraal (1956) in his review of H. impeltatum has described the high degree of variation among members of this species. It is unfortunate that only two specimens of H. impeltatum have been collected from West Pakistan, as these are atypical even by the criteria applied by Hoogstraal.

While both specimens are much smaller than those collected in other countries, both exhibit most of the major characteristics of this species. Nevertheless it must be kept in mind that undersized specimens are notorious for their abnormalities, and it is possible that these specimens represent atypical runts of a closely related species.

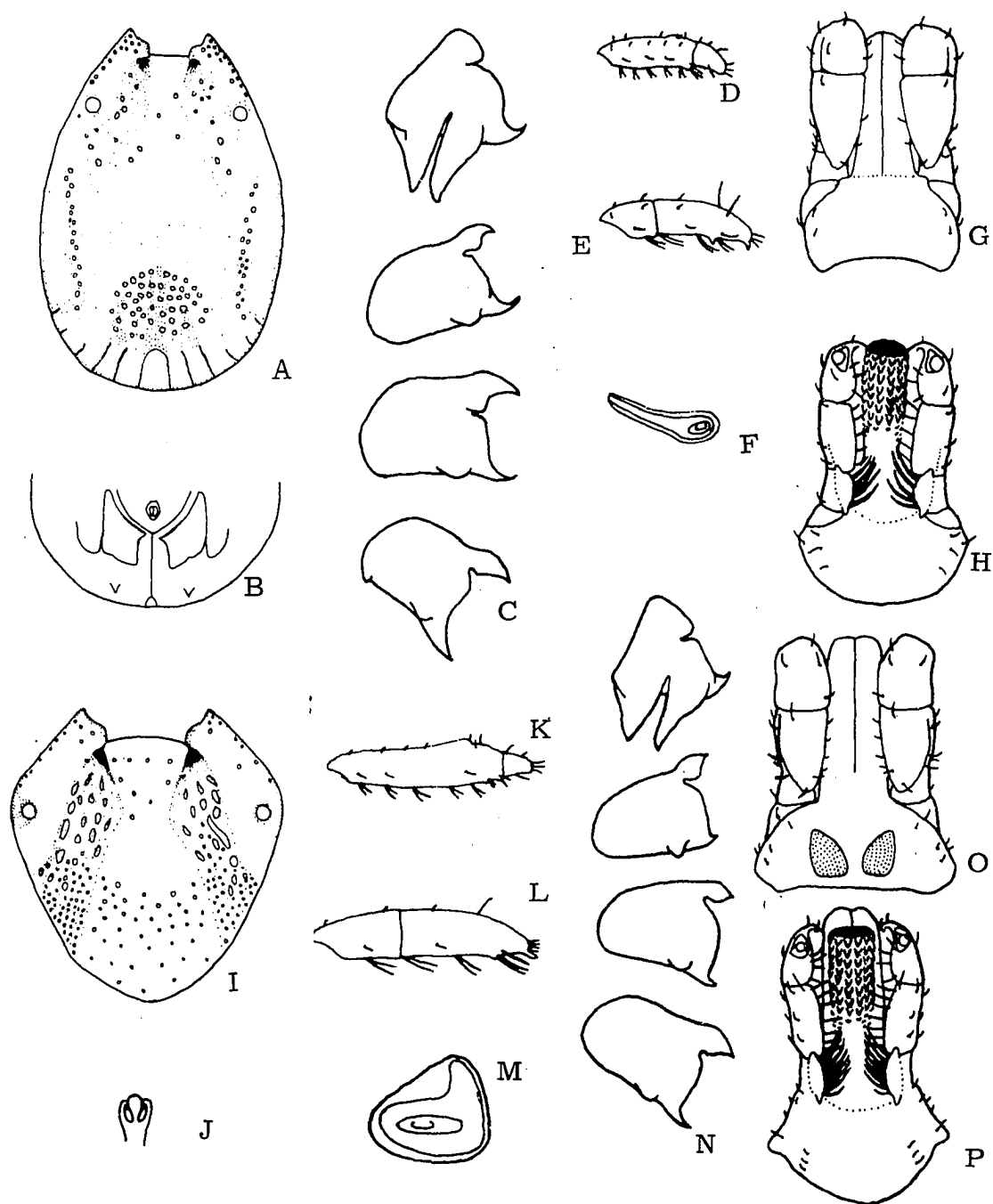
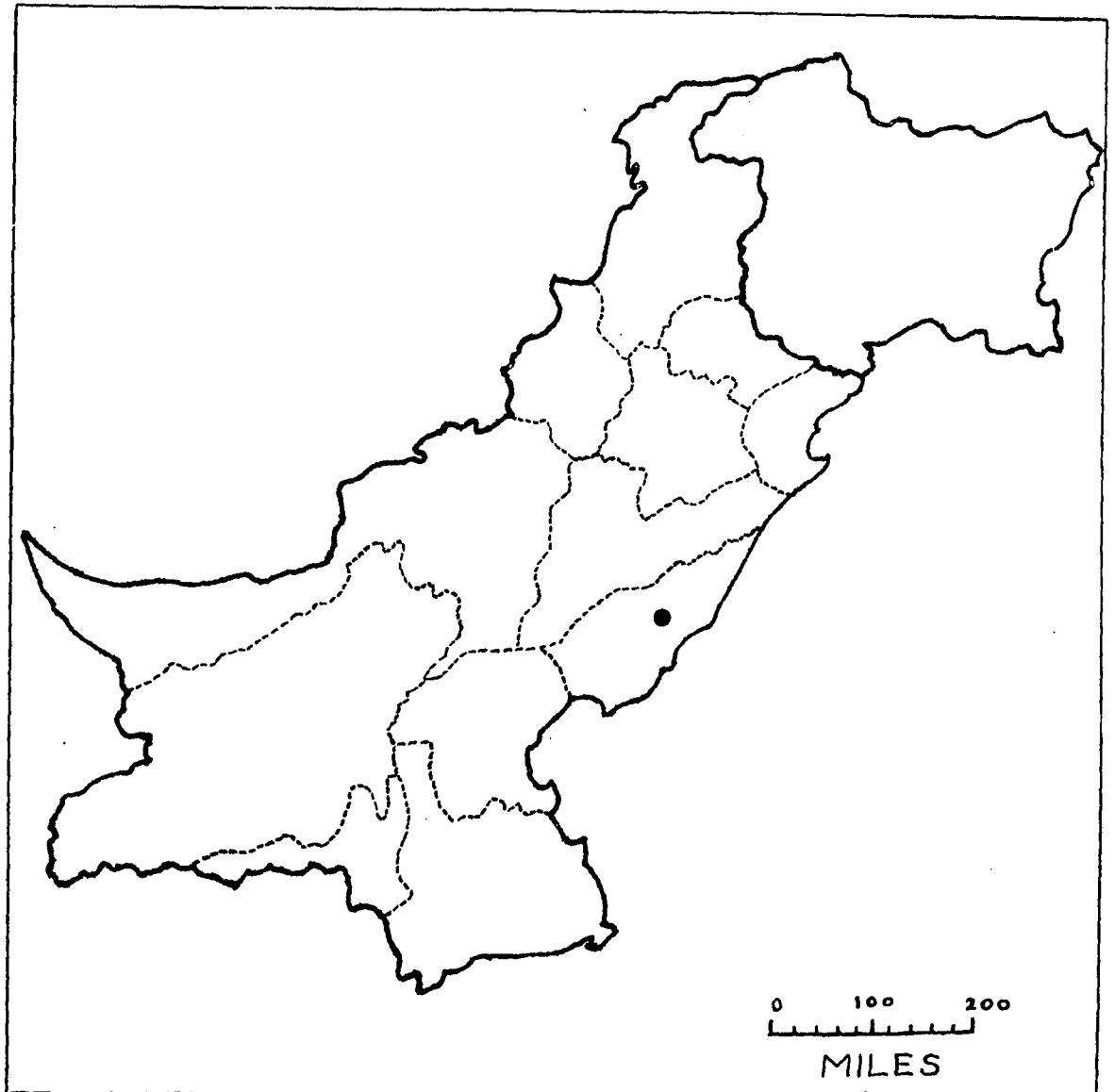


Fig. 25. Hyalomma impeltatum Schulze and Schlottke, 1929. A-H, male: A-scutum; B-adanal, subanal and accessory shields; C-coxae I-IV; D-tarsus I; E-tarsus IV; F-spiracular plate; G-capitulum, dorsal view; H-capitulum, ventral view; I-P, female: I-scutum; J-genital aperture; K-tarsus I; L-tarsus IV; M-spiracular plate; N-coxae I-IV; O-capitulum, dorsal view; P-capitulum, ventral view.



Map XXVII. Hyalomma impeltatum Schulze and Schlottke, 1929  
Geographical distribution — West Pakistan

HYALOMMA MARGINATUM ISAACI SHARIF, 1928

Synonymy

Hyalomma marginatum

Koch, 1844, Arch. Naturgesch., 10 (1): 221.

Hyalomma detritum

Schulze, 1919, S. B. Ges. Naturf. Fr., Berlin, 5: 189-196.

Delpy, 1949, Ann. Parasitol. Humaine et Comp., 24 (5-6): 464-494.

Nagar, 1962, Ent. Bull. (India), (3): 58-61.

Hyalomma aegyptium isaaci

Sharif, 1928, Rec. Indian Mus., 30 (3): 310, 311.

Hyalomma marginatum isaaci

Kaiser and Hoogstraal, 1963, J. Parasit., 49 (1): 130-139.

Kaiser and Hoogstraal, 1964, Acarologia, 6 (2): 257-286.

Hosts, Distribution and Biology

In West Pakistan adults of Hyalomma marginatum isaaci were found in 125 collections from buffalo (62 collections), cattle (24 collections), camels (17 collections), sheep (15 collections) and goats (4 collections). Single collections were also made from Sus scrofa cristatus, Gazella gazella bennetti and Alectoris graeca koroviakovi. Col-

lections were made in every month of the year. Elsewhere this subspecies has been collected off horses, dogs and man, as well as from Lepus nigricollis and Cervus elaphus wallichi. In nature immatures of this species have been collected from a Blue Rock Thrush (Monticola solitaria pandoo) in Kashmir, a Domestic Sparrow (Passer domesticus) in Kutch and Chukor (Alectoris graeca koroviakovi) in Kalat Division.

H. m. isaaci has been collected throughout West Pakistan, and is common in the Indus Basin. Elsewhere it is frequently found in India and Ceylon. Less frequently it is found in Kashmir and single specimens have been reported from Nepal and Afghanistan.

H. m. isaaci was reared in the laboratory by Rau (1963). Immature stages fed on guinea pigs and adults fed on rabbits.

#### Disease Relationship

Unknown.

#### Description - Male (Fig. 26, A-H)

1. Body. Brown. Robust; integument of engorged specimens stretched to give width greater than that of scutum. Ten specimens, length 4.7 mm - 5.4 mm, average 5.2 mm; width 2.6 mm - 3.5 mm, average 3.0 mm.

2. Scutum. Dark glossy brown, subrectangular and narrowing anteriorly. Sides and posterior margin slightly convex. Cervical

grooves commence as deep pits, rapidly broaden and become shallow, terminating in the anterior third of the scutum. Lateral grooves long and distinct, extending to just below the level of the eyes. Postero-median and paramedian grooves prominent and separated by an additional pair of shallow grooves. In the scutal midregion another pair of grooves, equal in length to the lateral grooves, extend from below the eyes to a point between the lateral and paramedian grooves. Festoons prominent and partially coalesced. Numerous small punctations in posterior depressions, scapular regions with medium sized punctations, few large punctations mainly in lateral regions. Eyes medium sized, circular and deeply socketed.

3. Venter. Yellowish brown. Adanal shields dark brown and well developed, posterior margins angular. Subanal shields situated directly below adanals. Spiracular plates comma-shaped with strong dorsal projections. Integumental regions around plates with numerous setae.

4. Legs. Strong and dark brown with white rings on the distal part of each segment. Coxa I with double spurs typical of this subgenus. Coxae II, III with medium sized outer spurs. Coxa IV with weak outer and rudimentary inner spur.

5. Capitulum. Average length 1.1 mm, average width 0.7 mm. Posterior margin of basis capituli concave, cornua rudimentary.

6. Hypostome. Average length 0.7 mm. Tip bluntly rounded, dentition 3/3, teeth moderate.

## Description - Female (Fig. 26, I-P)

1. Body. Brown. Ten specimens, length 5.1 mm (unengorged) - 12.2 mm (engorged), width 2.7 mm (unengorged) - 9.0 (engorged).
2. Scutum. Deep brown. Cordiform with wavy posterior margin. Length 1.8 mm - 2.3 mm, average 2.1 mm; width 1.9 mm - 2.2 mm, average 2.1 mm. Cervical grooves deep, extending to the posterolateral margins of the scutum. Punctations medium sized, limited mainly to the anterior half of the scutum. Eyes prominent, circular and deeply socketed.
3. Venter. Genital aperture between coxae II. Operculum widely triangular and rounded posteriorly; in profile it is bulging and depressed posteriorly. Spiracular plates ovate, with short thick dorsal projections. Area around spiracular plates pilose.
4. Legs. As in the male, light colored rings more prominent.
5. Capitulum. Length 1.1 mm - 1.4 mm, average 1.3 mm; width 0.8 mm - 1.0 mm, average 0.9 mm. Posterior margin of basis capituli straight, cornua absent. Dorsal porose areas circular.
6. Hypostome. Average length 0.8 mm, tip bluntly rounded, dentition 3/3, teeth moderate.

## Remarks

Hyalomma plumbeum (Panzer, 1795) is considered by some Western workers to be a synonym of H. marginatum (some Soviet



workers hold the reverse position). Soviet scientists have described several subspecies of H. plumbeum and investigated their pathogen vector potential. They found that members of this species are vectors of the viruses of Crimean hemorrhagic fever, Uzbekistan hemorrhagic fever, similar Middle-Asian hemorrhagic fevers, Coxiella burneti, Nuttalia equi, and are suspect as vectors of Piroplasma caballi.

In view of the medical and veterinary importance of H. plumbeum, it is hoped that its taxonomic relationship to Pakistani populations can soon be established.

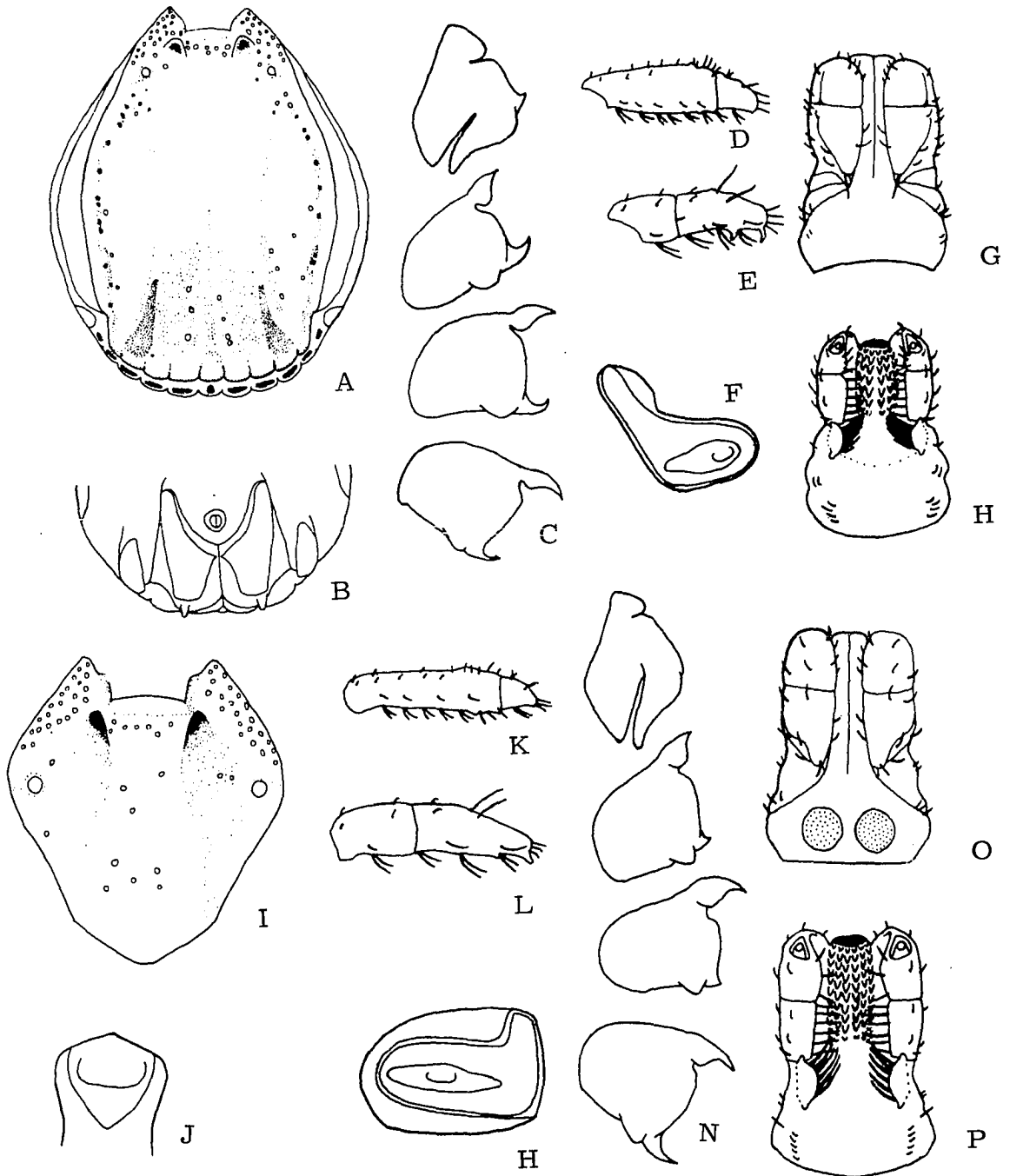
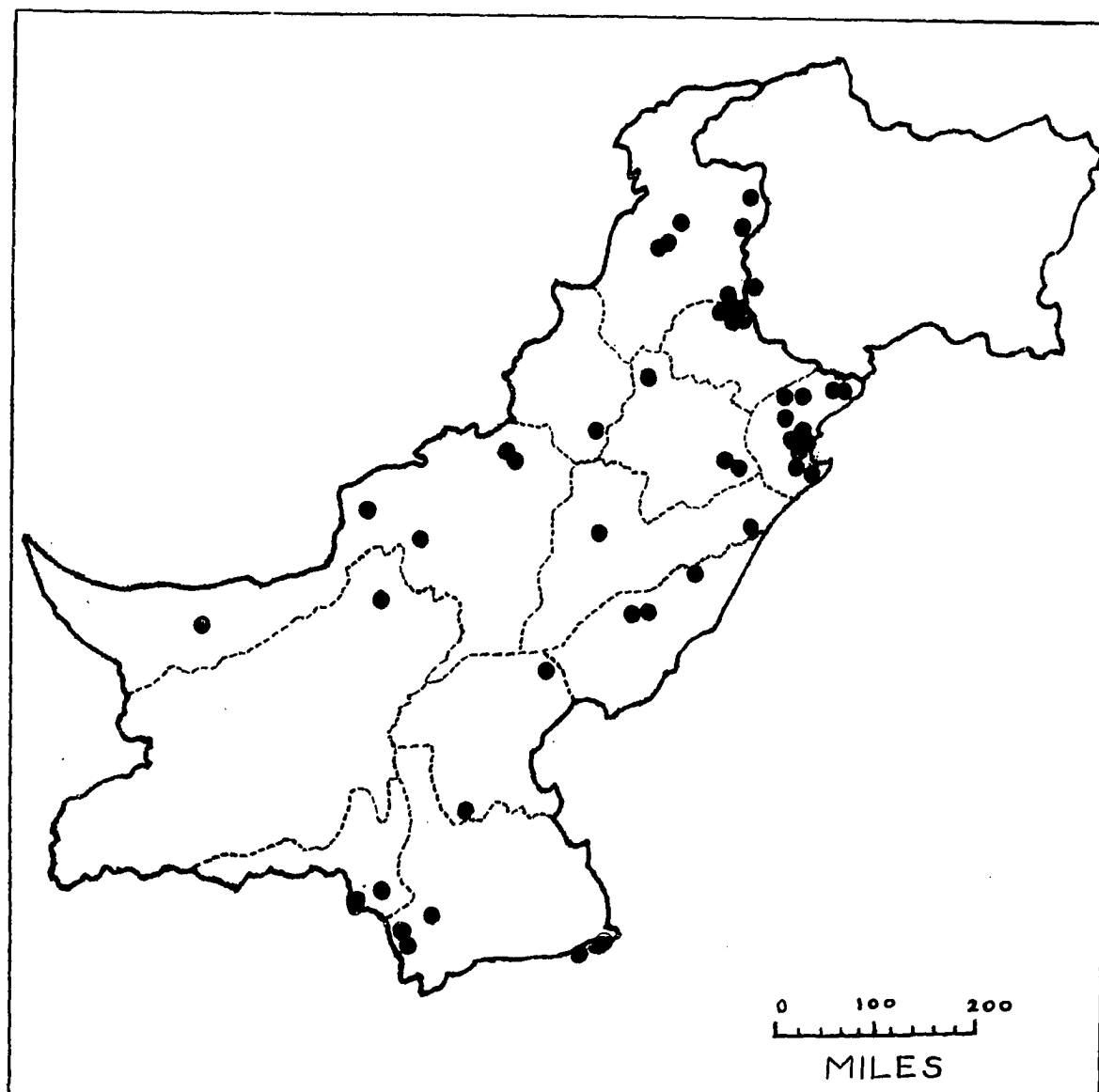


Fig. 26. Hyalomma marginatum isaaci Sharif, 1928. A-H, male: A-scutum; B-adanal, subanal and accessory shields; C-coxae I-IV; D-tarsus I; E-tarsus IV; F-spiracular plate; G-capitulum, dorsal view; H-capitulum, ventral view. I-P, female: I-scutum; J-genital aperture; K-tarsus I; L-tarsus IV; M-spiracular plate; N-coxae I-IV; O-capitulum, dorsal view; P-capitulum, ventral view.



Map XXVIII. *Hyalomma marginatum isaaci* Sharif, 1928  
Geographical distribution — West Pakistan

HYALOMMA MARGINATUM TURANICUM POMERANTSEV, 1946

Synonymy

Hyalomma marginatum

Koch, 1844, Arch. Naturgesch. , 10 (1): 221.

Hyalomma marginatum turanicum

Pomerantsev, 1946, Opred. Faune SSSR Zool. Muz. Akad. Nauk,  
Leningrad, 26: 1-28.

Kaiser and Hoogstraal, 1963, J. Parasit. , 49 (1): 130-319.

Kaiser and Hoogstraal, 1964, Acarologia, 6 (2): 257-286.

Hyalomma rufipes glabrum

Delpy, 1949, Ann. Parasitol. Humaine et Comp. , 24 (1-2): 97-  
109.

Hyalomma plumbeum turanicum

Pomerantsev, 1950, Fauna of the USSR, 4 (2): 194-195.

Hyalomma turanicum

Hoogstraal, 1956, African Ixodoidea, Vol. I, Ticks of the Sudan:  
527-532.

Hosts, Distribution and Biology

In West Pakistan collections of Hyalomma marginatum turanicum  
were made from sheep (25 collections), camels (13 collections), cattle

(13 collections) and goats (7 collections). One collection was made from Lepus capensis tibetanus. Collections were made from March through November.

H. m. turanicum is common to Quetta and Kalat Divisions. It has also been collected in the divisions of D. I. Khan, Bahawalpur, Karachi, Peshawar, Multan and Rawalpindi.

Elsewhere H. m. turanicum has been found in the Soviet Union, India, Afghanistan, the Middle East and many regions of Africa.

The following sections are taken from Pomerantsev (1950):

The season of adult parasitism covers the entire warm period beginning in the valleys at the end of March and in the mountains a bit later — end of April or beginning of May. Maximum infestation of animals is observed in the first half of the yearly warm period.

Experimental observations on the development of H. plumbeum [=marginatum] turanicum give the following periods of development during the summer months. . . : inactive period of female to the beginning of oviposition - 28 days, development of ova - 36 days, feeding of larvae - 8 days, feeding of nymphs - 8 days, inactive period of nymph up to the summer molt to adult - 24 days, fall and winter inactive period - 7 months.

The insufficient knowledge of the seasonal dynamics of the active attack on the host of larvae and in past adults prevents us from reaching any conclusions as to the length of the entire cycle; according to our data and an analogy with H. plumbeum plumbeum Panz. [=marginatum marginatum] it may be supposed that the cycle lasts one year and shows a Winter delay in the development of hungry adults and satiated nymphs. . .

. . . Larvae feed and molt to nymph on desert partridge, (Alectoris kakelik kakelik), pheasant (Phasianus chrysomelas bianchii, Columba livia neglecta, C. evermanni, Streptopelia turtur arenicola, Neophron percnopterus, Coracias garrula, Merops persicus, Upupa epops, Sturnus vulgaris dresseri, Pastor roseus, Carduelis carduelis subcaniceps, Passer domesticus bactrianus, P. mon-

tanus zaissanensis, Miliaria calandra buturlini, Emberiza stewarti, E. buchanani huttoni, E. ieterica, Melanocorypha calandra, Calandrella acutirostris, Alauda gulgula inconspicua, Anthus campestris griseus, Sitta tephronota, Lanius minor, L. collurio isabellinus, Phylloscopus nitedus viridanus, Sylvia curruca, S. althaea, Saxicola torquata, Oenanthe capistrata, O. opistoleuca, and Pheonocurus ochruros phoenicuroides.

Cattle serve as the main hosts of adults; of the birds, desert partridge, E. buchanani huttoni and Melanocorypha calandra are most frequently and heavily infested with larvae and nymphs, also field sparrows, kekliks and Alauda gulgula inconspicua.

.....  
 . . . This subspecies is extremely widely distributed in a vertical-zonal direction, inhabiting "tugai" — meadow formations, meadow-steppes, fields sections, on slopes of foothills reaching up to the upper timberbush belt of mountains. . . .

#### Disease Relationship

Delpy (1952) showed that H. rufipes glabrum (= H. marginatum turanicum) can transmit Theileria annulata to cattle but concluded that it is "not of considerable importance" as a vector in Iran.

#### Description - Male (Fig. 27, A-H)

1. Body. Light to dark brown. Ten specimens, length 4.8 mm - 5.6 mm, average 5.2 mm; width 2.8 mm - 3.5 mm, average 3.1 mm. Integument frequently distended to give width greater than that of scutum.

2. Scutum. Ovate. Length 3.9 mm - 4.5 mm, average 4.3 mm; width 2.5 mm - 3.0 mm, average 2.7 mm. Cervical grooves start as deep pits, rapidly broaden and extend as shallow grooves into the mid-

dle third of the scutum. Lateral grooves long and shallow, sometimes partially obscured by punctations, extending to just below the eyes. Posteromedian and paramedian grooves shallow and indistinct. Numerous small and shallow punctations cover the whole scutum. Fестоons present but partially coalesced. Eyes medium sized, circular and deeply socketed.

3. Venter. Adanal and subanal shields similar to those of Hyalomma marginatum isaaci. Spiracular plates comma-shaped, dorsal projections long and thin. Area around plates pilose.

4. Legs. As in H. m. isaaci, but with less sharply contrasting rings.

5. Capitulum. Length 1.0 mm - 1.2 mm, average 1.1 mm; width 0.6 mm - 0.7 mm, average 0.7 mm. Posterior margin of basis capituli straight, cornua small.

6. Hypostome. Average length 0.7 mm, tip bluntly rounded and notched. Dentition 3/3, teeth moderate.

#### Description - Female (Fig. 27, I-P)

1. Body. Tan to brown. Ten specimens, length 5.7 mm (unengorged) - 16.0 mm (engorged); width 3.1 mm (unengorged) - 10.5 mm (engorged).

2. Scutum. Cordiform, posterior margin bluntly rounded. Length 2.1 mm - 2.5 mm, average 2.4 mm; width 2.1 mm - 2.5 mm, average 2.3 mm. Cervical grooves extend as wide and moderately

deep depressions to the posterolateral margins. Small punctations present on anterior half of scutum and in cervical grooves. Eyes large, circular and deeply socketed.

3. Venter. Yellowish brown. Genital aperture between coxae II. Operculum widely triangular and bulging in profile. Spiracular plates ovate with short narrow dorsal projections. Area around plates pilose.

4. Legs. Similar to those of H. m. isaaci, but with less sharply contrasting rings.

5. Capitulum. Length 1.2 mm - 1.5 mm, average 1.4 mm; width 0.9 mm - 1.0 mm, average 1.0 mm. Posterior margin of basis capituli slightly concave, cornua rudimentary. Porose areas of basis prominent, ovate and separated by a high ridge.

6. Hypostome. Average length 0.9 mm, tip bluntly rounded and notched. Dentition 3/3, teeth moderate.

#### Remarks

The remarks on H. marginatum isaaci also hold true here. In view of the great amount of epidemiological work done by Soviet workers on this species complex it is most important that this taxonomic problem be resolved.

While H. marginatum isaaci and H. marginatum turanicum are both widely distributed in West Pakistan there are few examples of intergradation and overlap. Populations of H. m. isaaci are found mainly in the regions of the Indus Basin, while H. m. turanicum is most



commonly found in the drier regions west of the Indus.

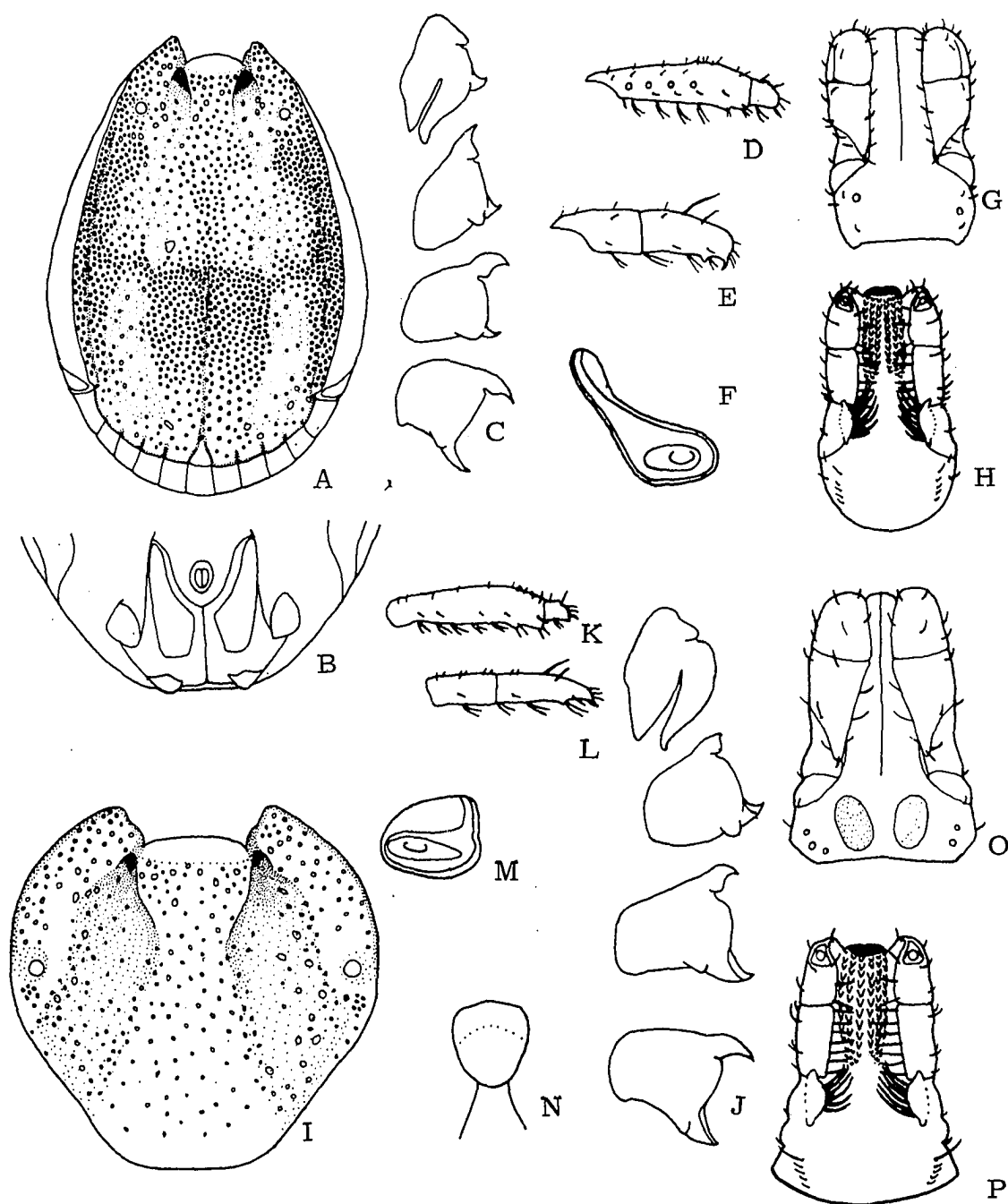
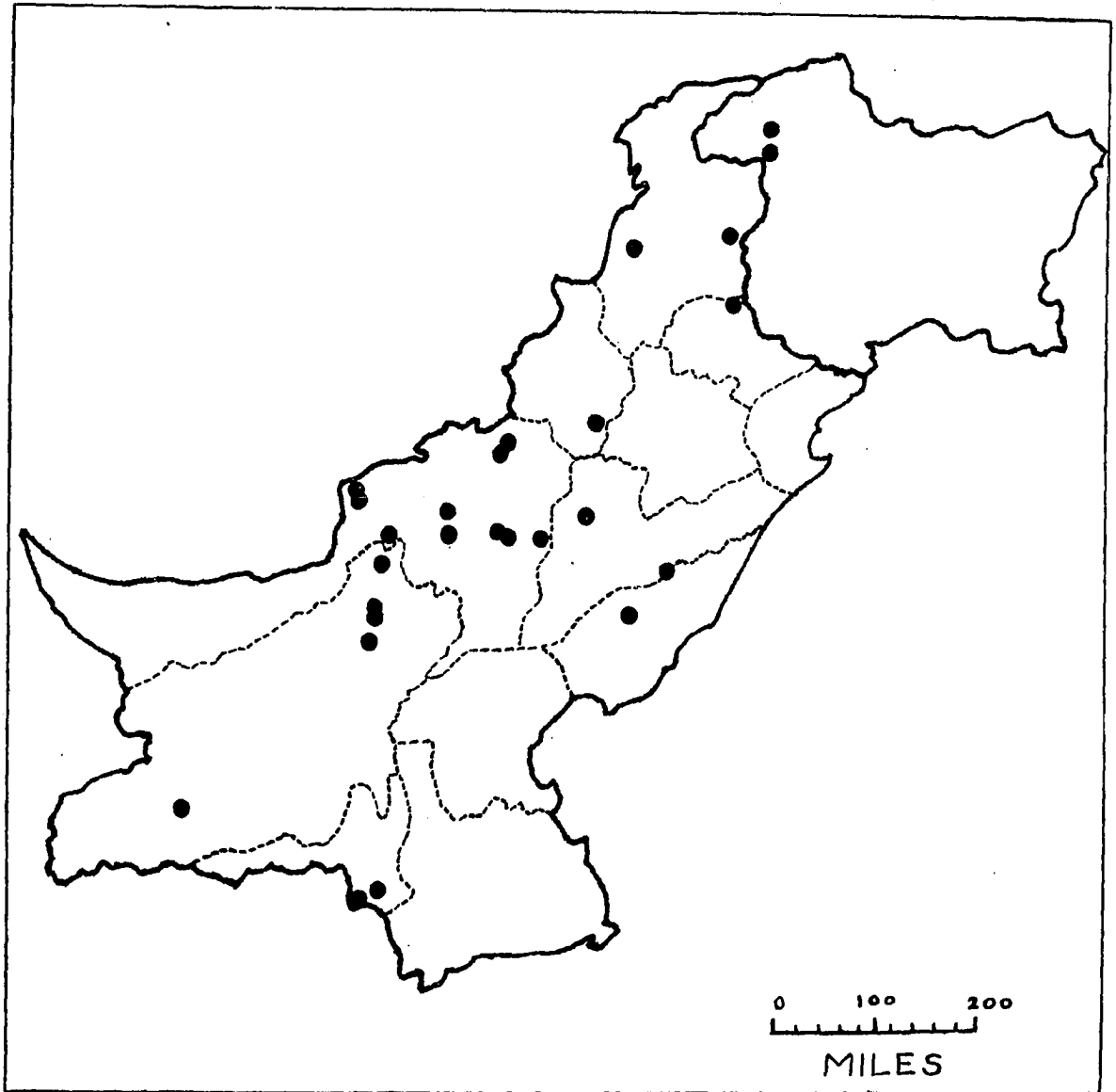


Fig. 27. Hyalomma marginatum turanicum Pomerantsev, 1946.  
 A-H, male: A-scutum; B-adanal, subanal and accessory shields; C-coxae I-IV; D-tarsus I; E-tarsus IV; F-spiracular plate; G-capitulum, dorsal view; H-capitulum, ventral view. I-P, female: I-scutum; J-coxae I-IV; K-tarsus I; L-tarsus IV; M-spiracular plate; N-genital aperture; O-capitulum, dorsal view; P-capitulum, ventral view.



Map XXIX. *Hyalomma marginatum turanicum* Pomerantsev, 1946  
Geographical distribution — West Pakistan

HYALOMMA SCHULZEI OLENEV, 1931

Synonymy

Hyalomma schulzei

Olenev, 1931, Mag. Parasit., Moscow, 2: 249-261.

Pomerantsev, 1950, Fauna of the USSR, 4 (2): 195, 196.

Hoogstraal, 1956, African Ixodoidea, Vol. I, Ticks of the Sudan:  
524-526, 889.

Kaiser and Hoogstraal, 1963, J. Parasit., 49 (1): 132, 133.

Hosts, Distribution and Biology

All specimens of Hyalomma schulzei collected in West Pakistan came from camels. Pomerantsev, however, lists cattle as secondary hosts. Hoogstraal (1956) reports that nymphs have been collected in Egypt and Sinai from Lepus capensis, Psammomys O. oheusus, and unfed, newly molted adults have been found in the burrows of Meriones c. crassus.

H. schulzei is found in a narrow belt which extends from Afghanistan and West Pakistan through Iran, Iraq and Israel into the Western Desert of Egypt. In West Pakistan the range of H. schulzei appears to be restricted to the Baluchistan Plateau. Collections were made at Gulistan, Dalbandin, Chagai and Nushki in Quetta Division, and Panj-

gur in Kalat Division.

H. schulzei is commonly found in the upland desert area of southeastern Iran. The climate of this region is characterized by very hot, long, dry summers and very cold winters. Pomerantsev reported the collection of adults in January and May. Pakistani collections were made in April, June and November, at elevations ranging from 4,000 to 8,000 feet.

#### Disease Relationship

Unknown.

#### Description - Male (Fig. 28, A-H)

1. Body. Light tan to dark brown. Seven specimens, length 6.8 mm - 9.5 mm, average 8.5 mm; width 4.3 mm - 8.5 mm, average 6.0 mm. The great width of engorged specimens is due to the lateral stretching of the integument.

2. Scutum. Dark brown, ovate, narrowing anteriorly. Length 5.9 mm - 8.2 mm, average 7.2 mm; width 3.4 mm - 5.9 mm, average 4.5 mm. Cervical grooves broad and very shallow, extending to the middle of scutum. Lateral grooves short and superficial, mostly obscured by many medium sized punctations. These punctations continue past the eyes into the tips of the scapulae. Posteromedian and paramedian grooves prominent as deep, ridged depressions. Parma light colored, subrectangular. Eyes circular, deeply socketed.

3. Venter. Yellowish brown. Genital aperture between coxae II. Adanal shields well developed and slightly curved with blunt posterior margins. The subanal shields are strong and situated laterally to the axis of the adanals. The spiracular plates are highly distinctive. They are ovate, short and lack the well developed dorsal projection common to the males of all other species in this genus.

4. Legs. Long and robust, especially leg IV. Color dark brown with narrow white rings at the distal part of each segment. Coxa I with strong double spur on posterior margin; the outer narrow, curving and pointed, the inner broader, straight and pointed. Coxae II - IV with single, weak outer spurs and weakly ridged on the inner posterior margin.

5. Capitulum. Length 1.2 mm - 1.7 mm, average 1.4 mm; width 1.0 mm - 1.4 mm, average 1.1 mm. Basis capituli wider than long, with many setae. Posterior margin of basis concave and angular; lateral regions of basis arced. Palps short, broad.

6. Hypostome. Bluntly rounded. Length 0.7 mm - 1.0 mm, average 0.9 mm. Dentition 3/3, teeth moderate.

#### Description - Female (Fig. 28, I-P)

1. Body. Dark brown. Six specimens, length 9.9 mm (partially engorged) - 22.0 mm (fully engorged), width 5.3 mm (partially engorged) - 12.5 mm (fully engorged).

2. Scutum. Dark reddish brown, cordiform, posterior margin

broadly rounded. Length 2.0 mm - 3.0 mm, average 2.6 mm; width 1.9 mm - 2.8 mm, average 2.6 mm. Cervical grooves deep trough-like, usually reaching the posterior margin. Punctations are heavy and mixed, small to large and randomly distributed over the scutum. Many minute punctations in posteromedian field.

3. Venter. Brown. Genital aperture on the median line slightly above coxae II. Operculum large, subrectangular, with rounded corners, wider than long. Spiracular plates subovate, with short, wide dorsal projections.

4. Legs. Longer and thinner than those of the male. Pale yellow dorsally, yellowish brown ventrally, distal portions of each segment pale. Coxae generally similar to those of the male, with inner spurs or ridges either reduced or absent.

5. Capitulum. Length 1.2 mm - 1.5 mm, average 1.4 mm; width 0.8 mm - 1.1 mm, average 1.0 mm. Basis capituli as in the male; porose areas ovoid, separated by high ridge. Posterior margin of basis capituli less concave than in the male.

6. Hypostome. Average length 0.9 mm, tip bluntly rounded. Dentition 3/3, teeth moderate.

#### Remarks

H. schulzei is comparatively rare in West Pakistan and has not been found east of Quetta. It frequently is collected along with Hyalomma dromedarii, but can be quickly separated from that species by

the shape of the male's spiracular plate and by the shape of the female's operculum.



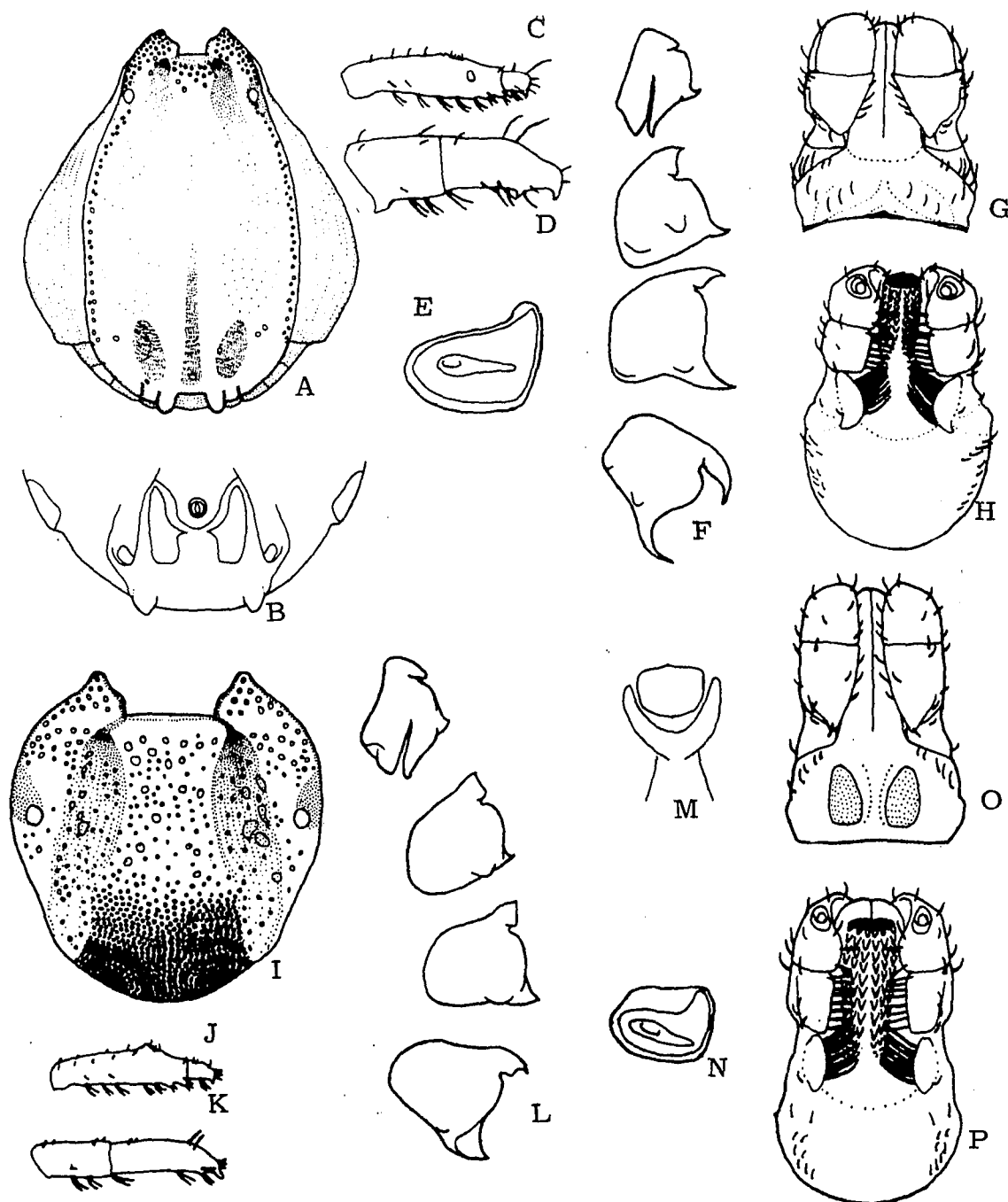
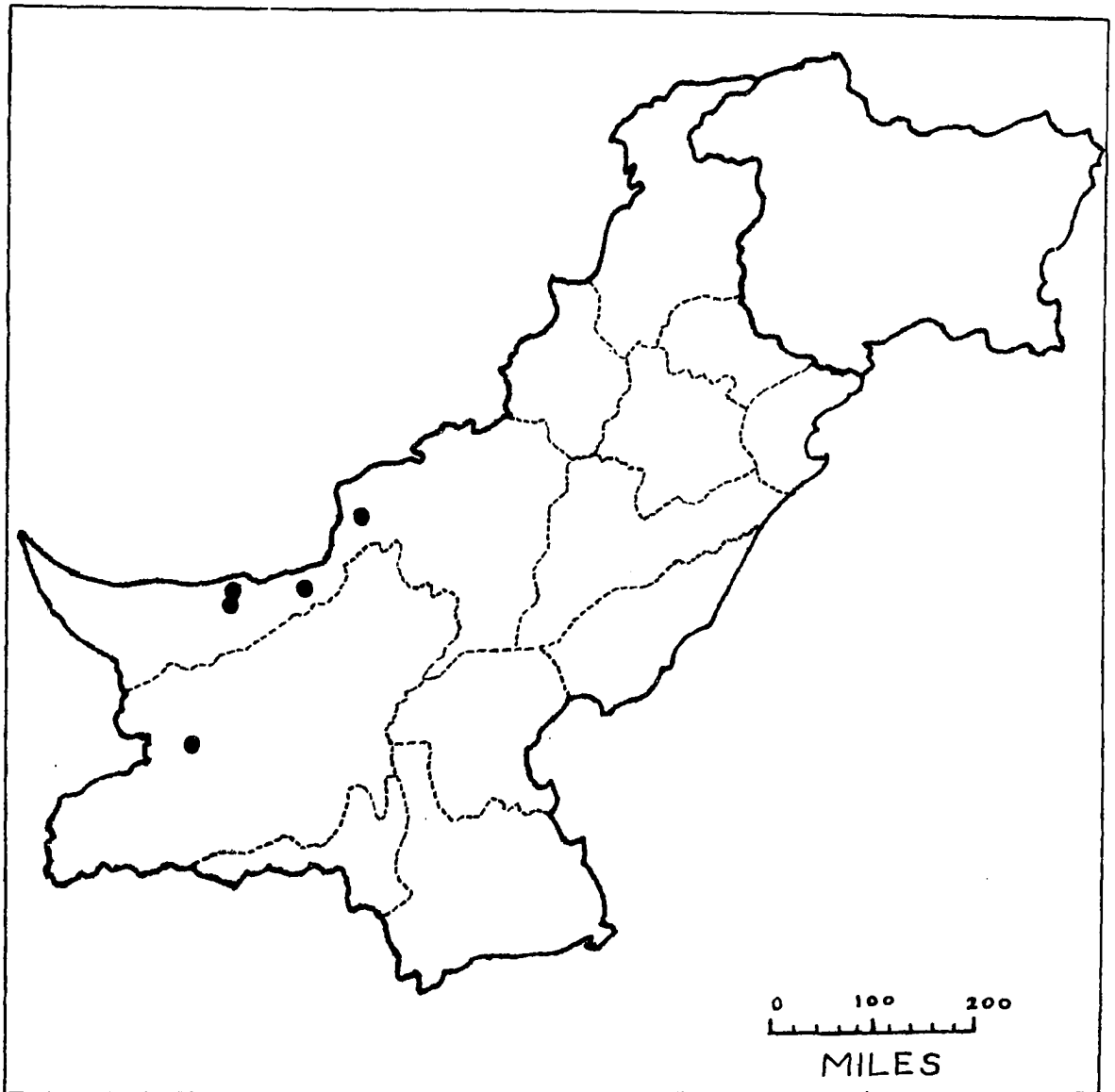


Fig. 28. Hyalomma schulzei Olenov, 1931. A-H, male: A-scutum; B-adanal, subanal and accessory shields; C-tarsus I; D-tarsus IV; E-spiracular plate; F-coxae I-IV; G-capitulum, dorsal view; H-capitulum, ventral view. I-P, female: I-scutum; J-tarsus I; K-tarsus IV; L-coxae I-IV; M-genital aperture; N-spiracular plate; O-capitulum, dorsal view; P-capitulum, ventral view.



Map XXX. Hyalomma schulzei Olenov, 1931  
Geographical distribution — West Pakistan

## GENUS IXODES LATREILLE, 1795

### Introduction

The Ixodes of West Pakistan constitute a small group of species restricted to the higher elevations (above 6,000 ft.) of the northern hill areas. Due to the seasonal inaccessibility of these regions, collections were made only during the summer and fall, with the result that little information was gathered about the three species that were collected.

As only females and immature stages were collected and the male of Ixodes stromi is unknown, it is not possible to formulate a key to the males.

Examination of immature stages of this genus indicates that additional species await description.

### Key to the Females

1. Auriculae present ..... 2  
Auriculae absent ..... stromi
2. Auriculae weakly developed, cornua rudimentary, scutum rounded oval ..... persulcatus kaschmiricus  
Auriculae strongly developed, cornua small but prominent and pointed, scutum elongate oval ..... redikorzevi redikorzevi

IXODES PERSULCATUS KASCHMIRICUS POMERANTSEV, 1948

Synonymy

Ixodes persulcatus

Schulze, 1930, Zool. Anz., 90: 294-303.

Anastos, 1957, U. S. Pub. Health Serv. Publ. No. 548: 178-192.

Ixodes persulcatus kaschmiricus

Pomerantsev, 1948, Parazitol. Sborn. Zool. Inst. Akad. Nauk  
SSSR, 10: 20-21.

Hosts, Distribution and Biology

Ixodes persulcatus kaschmiricus was described by Pomerantsev in 1948 from a pair of adults collected in 1910 from the region of the Vardvan Maru River (a northern tributary of the Chenab River) in Kashmir. Pomerantsev (1950) later reported that this subspecies is not found in the Soviet Union. However a single female was later reported from the Thian-Shan Mountains.

Dr. Glen Kohls (personal communication) has several collections of this subspecies from sheep, cattle and clothing along the Srinagar-Yus Road in Kashmir (7,500<sup>±</sup> ft. altitude).

The specimen used in this work is from the British Museum collection (no number) and is labeled Ixodes ricinus. No date is given and

the host is listed as marten. The collecting region is Bogamang Glen in Hazara District, Peshawar Division.

### Disease Relationship

Unknown.

### Description - Male

As no males have been collected in West Pakistan the following description is taken from Pomerantsev (1948):

. . . Scutum oval; covered by regular minute punctations; pseudoscutum sparsely punctated by hardly noticeable minute and sparse punctations. Scapulae small. Dorsal cornua absent. Auriculae undeveloped. Posterior outline of basis capitulum from ventral side forms more or less rounded line. Hypostome with developed lateral spurs, appearing in their basic position as the result of fusion of several rows of rudimentary denticles. Posterior pair of denticles of hypostome more weakly developed than in the basic species. All coxae carry external spurs. Internal spur on coxa I relatively short. Internal spurs absent on coxae II-IV. Peritreme relatively small, rounded-oval, lie at a greater distance from coxa IV than the larger peritreme of the basic species.

### Description - Female (Fig. 29, A-I)

1. Body. Brown. One specimen, length 8.0 mm (engorged), width 4.6 mm (engorged).

2. Scutum. Rounded oval. Length 1.6 mm, width 1.5 mm. Scapulae small. Cervical grooves extending as faint depressions from the scapular regions into the posterior half of the scutum. Punctations

medium sized and shallow, covering entire scutum. Occasional fine setae on anterior third of scutum.

3. Venter. Genital aperture a wide transverse slit located between the posterior margins of coxae III. Preanal groove bluntly rounded anteriorly. Spiracular plates subcircular.

4. Legs. Coxae I-IV with small outer spurs. Coxa I with a strong inner spur of moderate length.

5. Capitulum. Length 1.0 mm, width 0.5 mm. Posterior margin of basis capituli weakly concave, cornua rudimentary. Dorsal depressions oval separated by a small shallow depression. Auriculae weakly developed.

6. Hypostome. Missing.

#### Remarks

Larvae of this species have been collected from a vole in Naran, Peshawar Division. Their relationship to this particular subspecies cannot be ascertained at this time.

Anastos (1957) has amassed considerable information on Ixodes persulcatus in the Soviet Union. However the taxonomic relationship of Ixodes persulcatus kaschmiricus to Ixodes persulcatus persulcatus is disputed by some workers who feel that kaschmiricus is worthy of specific rank.

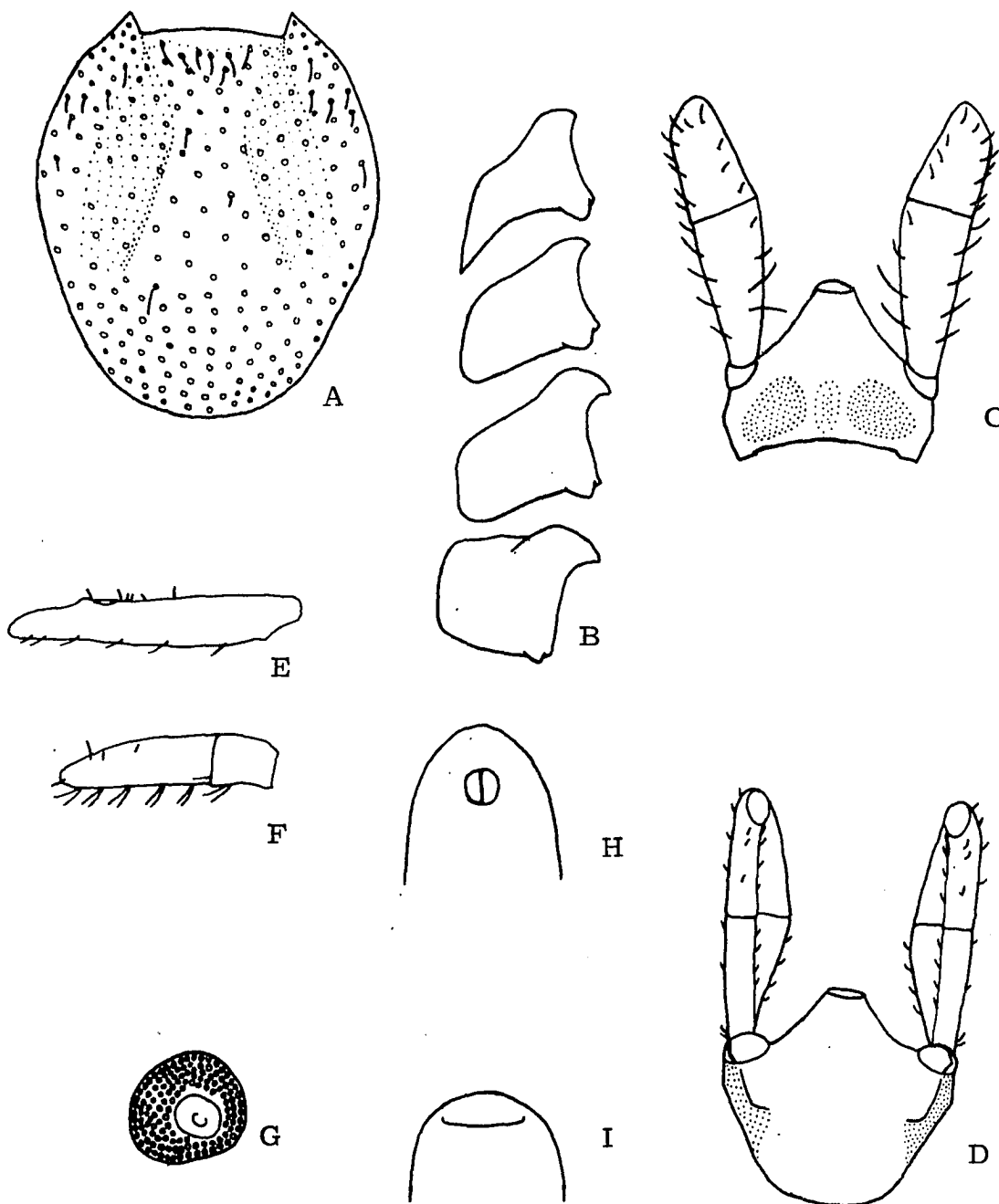
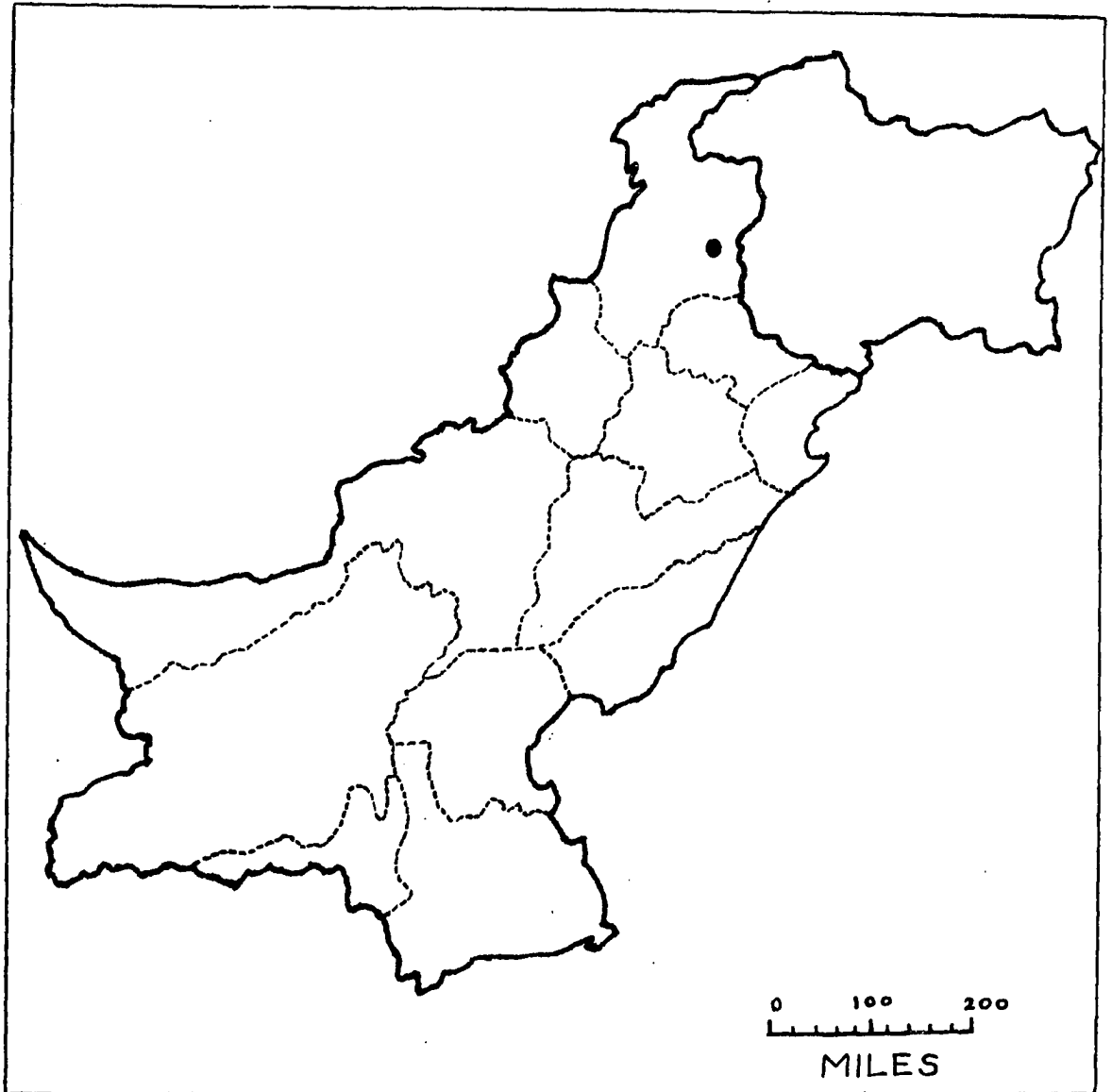


Fig. 29. *Ixodes persulcatus kaschmiricus* Pomerantsev, 1948.  
A-I female: A-scutum; B-coxae I-IV; C-capitulum,  
dorsal view; D-capitulum, ventral view; E-tarsus I;  
F-tarsus IV; G-spiracular plate; H-preanal groove;  
I-genital groove.



Map XXXI. *Ixodes persulcatus kaschmiricus* Pomerantsev, 1948  
Geographical distribution – West Pakistan



IXODES REDIKORZEVI REDIKORZEVI OLENEV, 1927

Synonymy

Ixodes redikorzevi

Olenev, 1927, Dokl. Akad. Nauk SSSR, 14: 219-224.

Ixodes redikorzevi redikorzevi

Pomerantsev, 1950, Fauna of the USSR, 4 (2): 56, 57.

Ixodes theodori

Warburton, 1927, Parasitology, 19: 405-410.

Hosts, Distribution and Biology

Pakistani collections of Ixodes redikorzevi redikorzevi came from Rattus sp. and Alticola sp. In the Soviet Union collections came from hares, lizards, mice, thrushes and other birds, and Citellus pygmaeus, Apodemus sylvaticus, Erinaceus ponticus, Microtus socialis satunini, Vormela sarmatica, Hemiechinus calligoni brachyotis, Evotomys rufocanus, Nesokia indica huttoni, Phylloscopus collybitus, Saxicola torquata, Oenanthe opistholeuca, Turdus atrogularis, Galerida cristata and Ophisaurus apodus.

Ixodes redikorzevi redikorzevi has been found in West Pakistan, the Soviet Union, Afghanistan, Egypt and Israel.

Anastos (1957) has summarized the known data on I. r. redikor-

zevi. This subspecies is found near Naran and Gitidas in forest zones of the Kagan Valley, Peshawar Division. Adults have been collected there in July, September and October. In the Soviet Union adults were collected in similar regions in April, May, October and December; and immature stages were found in April, June and August.

#### Disease Relationship

Unknown.

#### Description - Male

Pomerantsev (1950) gives the following description for the male of this species but points out that subspecific identification is not yet possible in this group.

. . . Small body, oval in shape. Scutum has even punctation and is covered with thin, light hair. Basis capituli as a rule has well developed dorsal cornua. Auriculae are vaguely expressed. Hypostome has 7 to 8 rows of denticles. Superficially it has a distinct identity with the hypostome of I. ricinus (L.), however it differs from the latter by less developed lateral and basal denticles. Pulvilli on tarsi I are markedly larger than those of the remaining pairs of legs. Coxae I - IV as a rule have both external and internal spurs; otherwise the internal spur of coxa IV is reduced. Membranous outgrowth of coxa is absent. Peritreme is elongated and oval in form. Palps and locomotor appendages carry relatively long setae.

#### Description - Female (Fig. 30, A-I)

1. Body. Yellowish brown. Three specimens, length 3.1 mm - 3.4 mm (partially engorged); width 1.5 mm - 1.8 mm (partially en-

gorged). Many medium sized setae on both dorsum and venter.

2. Scutum. Elongate oval, widest in mid regions. Length 1.2 - 1.4 mm, average 1.3 mm; width 0.9 mm - 1.1 mm, average 1.0 mm. Scapulae small and pointed. Cervical grooves shallow and indistinct, extending to the posterior half of the scutum. Punctations small, shallow, numerous, and uniformly distributed over the scutum. Setae long and numerous.

3. Venter. Genital aperture between coxae IV. Operculum oval, wider than long and resting on a triangular lip. Preanal groove bluntly pointed. Spiracular plate subcircular.

4. Legs. Long and slender. Coxa I with a thick, bluntly pointed outer spur and a long thin inner spur. Coxa II with a thick, bluntly pointed outer spur and a small inner spur. Coxa III with a short, thick, bluntly pointed outer spur and a rudimentary inner spur. Coxa IV with a single, short, thick, bluntly pointed outer spur.

5. Capitulum. Average length 0.8 mm, average width 0.5 mm. Palps long and slender. Auriculae large and well developed. Posterior dorsal margin of basis capituli slightly concave. Cornua small but prominent and pointed. Dorsal depressions subovate and extending to posterior margins of basis.

6. Hypostome. Missing.

#### Remarks

While the three specimens collected in West Pakistan conform in

general to the Pomerantsev description of I. r. redikorzevi, each possesses some of the characters of Ixodes redikorzevi emberizae

Pomerantsev, 1950. The shape of the preanal groove and the length of the scutal setae are more typical of emberizae and indicate that these specimens may represent an intermediate population. More specimens are required before final determinations can be made in this species complex.

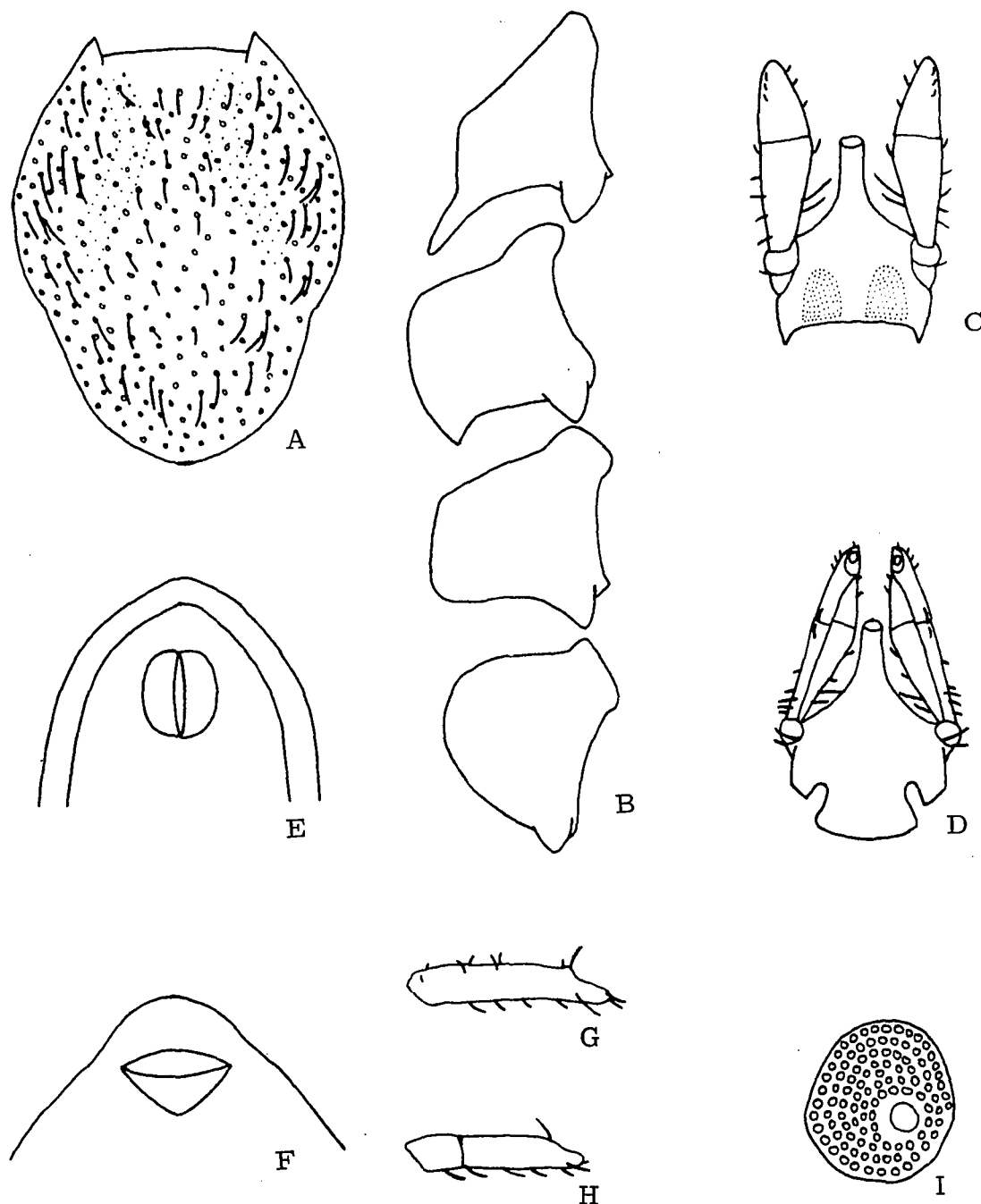
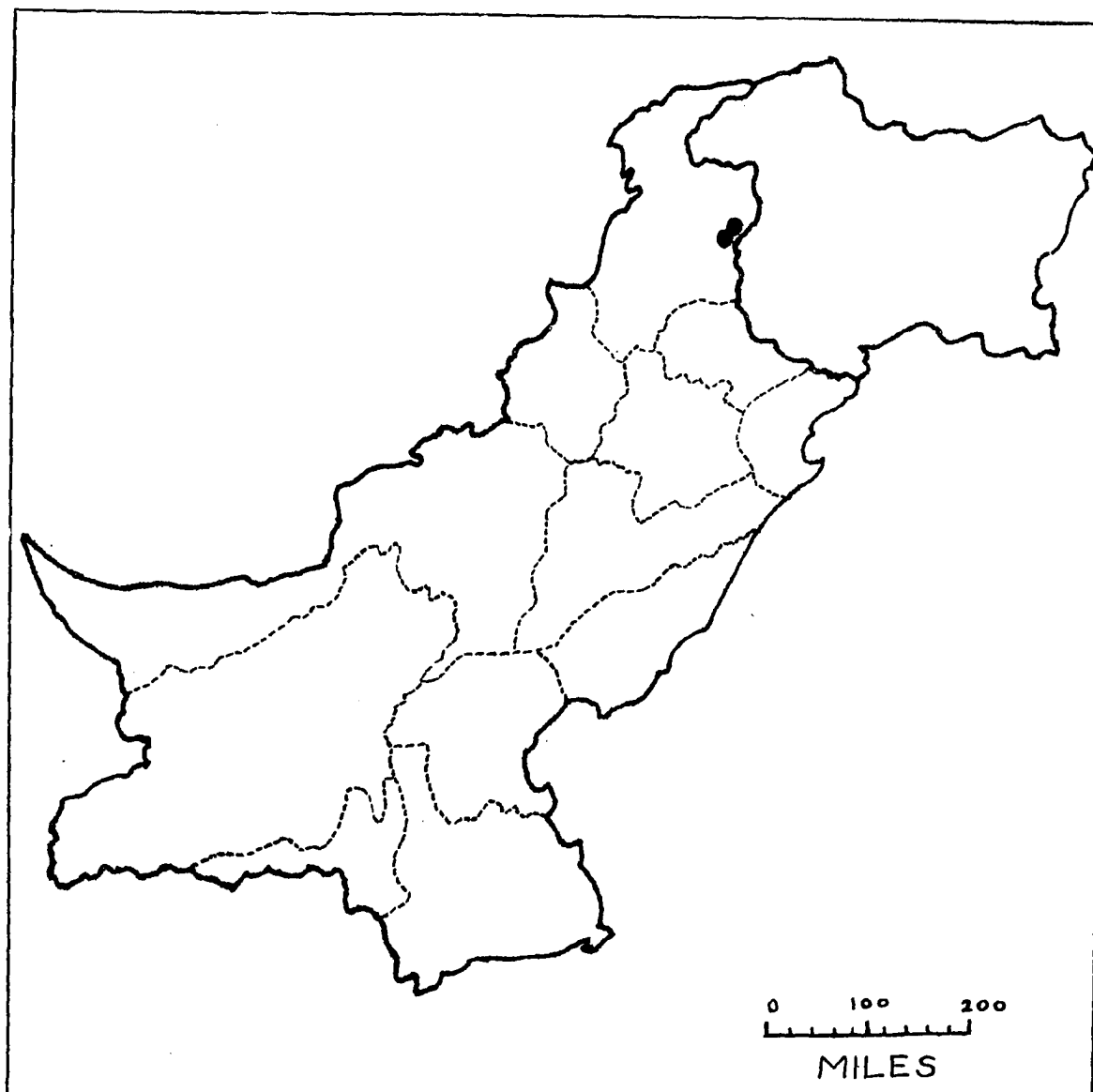


Fig. 30. *Ixodes redikorzevi redikorzevi* Olenev, 1931.  
 A-I, female: A-scutum; B-coxae I-IV; C-capitulum, dorsal view; D-capitulum, ventral view; E-preanal groove; F-genital groove; G-tarsus I; H-tarsus IV; I-spiracular plate.



Map XXXII. Ixodes redikorzevi redikorzevi Olenev, 1927  
Geographical distribution — West Pakistan

## IXODES STROMI FILIPPOVA, 1957

### Synonymy

#### Ixodes stromi

Filippova, 1957, Zool. Zh. , 36 (6): 864-869.

### Hosts, Distribution and Biology

Only four adult female specimens of Ixodes stromi have been collected in West Pakistan. One was from Alticola sp. near Naran in Peshawar Division in July, 1964. The others were from Apodemus sp. and Cricetulus sp. near Naltar in Gilgit in August, 1964. Immature stages of this species were collected throughout the Kagan Valley and Gilgit from the aforementioned hosts during the summer of 1964.

The male of this species is unknown.

The known distribution of this species is limited to the Soviet Union and West Pakistan, but its actual distribution is probably much wider.

Filippova (1957) gives the following information on Ixodes stromi:

It is found in median elevation (2000-2800 meters above sea-level) in the forest-meadow-steppe belt. In the limits of this belt it is found only in rocky slopes, stone and mountainous projections frequently covered with ancient bush and grassy vegetation. Such habitats are very typical of the medium elevations of the central Iran-Schan mountains. . . .

As hosts of larvae, nymphs and adults served the

mountain silver field mouse (Alticola argentatus Severy) the typical inhabitant of the rocky habitats and also the forest Tian-Schan field mouse (Clethrionomys frater Thomas) the narrow habit field mouse (Stenocranius gregalis Pall.) and the forest mouse (Apodemus sylvaticus L.), that is rodents inhabiting various types of habitats within the limits of the median elevation mountain zone, including the rocky ones. During the season of the work (May-August) Ixodes stromi was very rare. Only 0.12% of the rodents collected within the limits of the forest-meadow-steppe belt, and 1.1% rodents collected also in the rocky habitats were infested with this species.

Females were found in March, nymphs in March, June and August and larvae from June to August.

### Disease Relationship

Unknown.

### Description - Female (Fig. 31, A-I)

1. Body. Yellow to reddish brown. Three specimens, length 4.1 mm (partially engorged) - 5.6 mm (engorged), width 2.1 mm (partially engorged) - 2.9 mm (engorged).
2. Scutum. Ovate, widest in middle third. Length 1.9 mm, width 1.0 mm. Scapulae long, pointed and broad. Cervical grooves extend as faint depressions from base of scapulae to posterior third of scutum. Numerous small shallow punctations cover entire scutum. Many fine setae on anterior two-thirds of scutum. Eyes absent.
3. Venter. Genital opening between coxae III. Operculum broad and flaplike, bulging in profile. Spiracular plates subcircular. Pre-anal groove bluntly pointed anterior to the anus.



4. Legs. Long and thin. Coxa I with two small widely separated spurs, the inner spur slightly longer than the outer. Coxae II-IV with single, short, wide, outer spurs. Coxa II may show rudiments of an inner spur.

5. Capitulum. Average length 0.8 mm, average width 0.5 mm. Palps long and thin, over three times longer than wide. Palpal article 1 with a ventrolateral spur-like outgrowth. Dorsal depressions subtriangular. Posterior margin of basis capituli concave, cornua rudimentary. Auriculae absent.

6. Hypostome. Lanceolate, average length 0.4 mm. Dentition 3/3, teeth small.

#### Remarks

Filippova (1957) has selected I. stromi as the type for the subgenus Ixodiopsis. This grouping contains eleven species including I. kempi Nuttall, 1913 from Kobo, India. The close morphological resemblance shown by several members of this group raises the question of the validity of several of these species. Further investigation in this area is required.

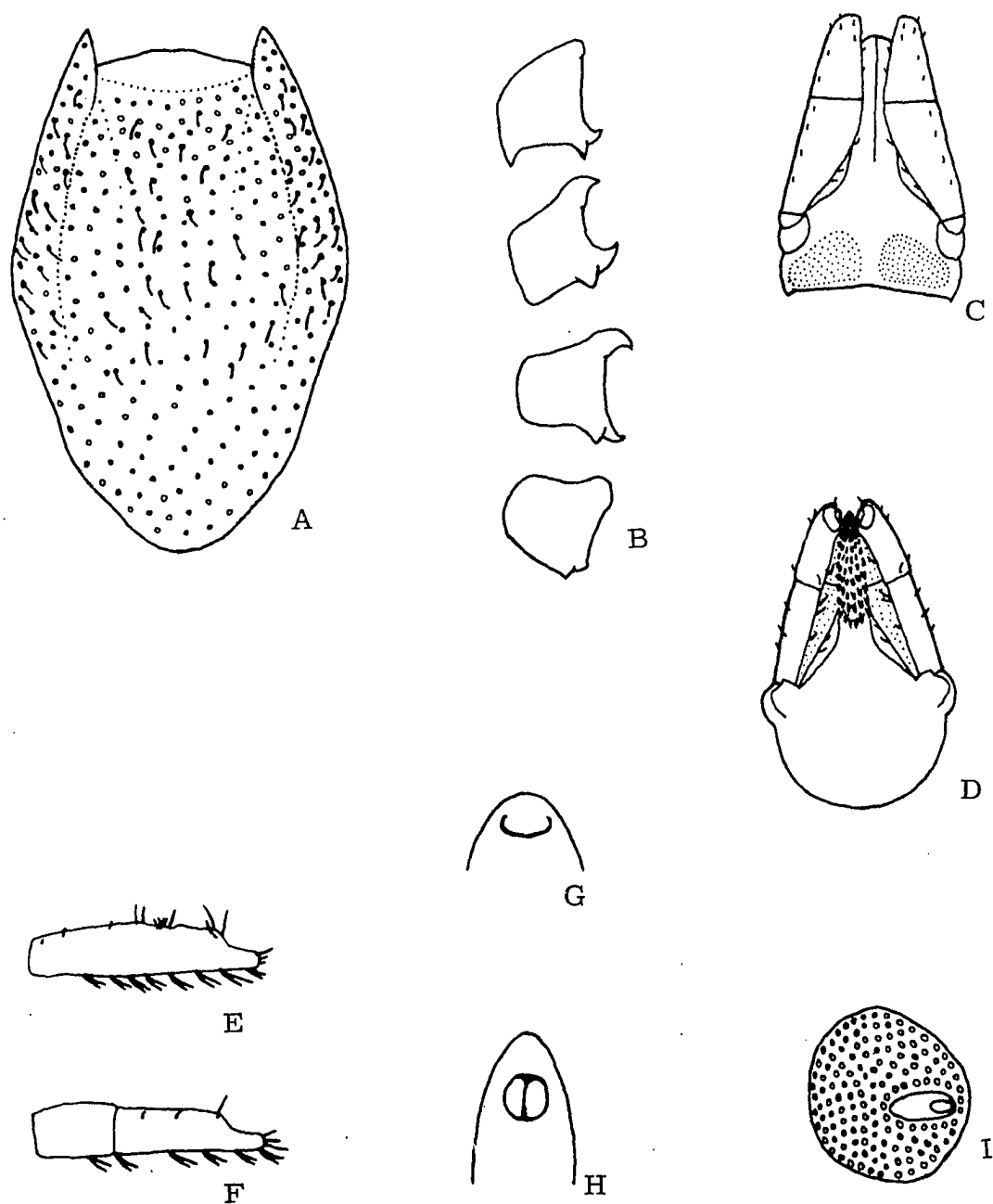
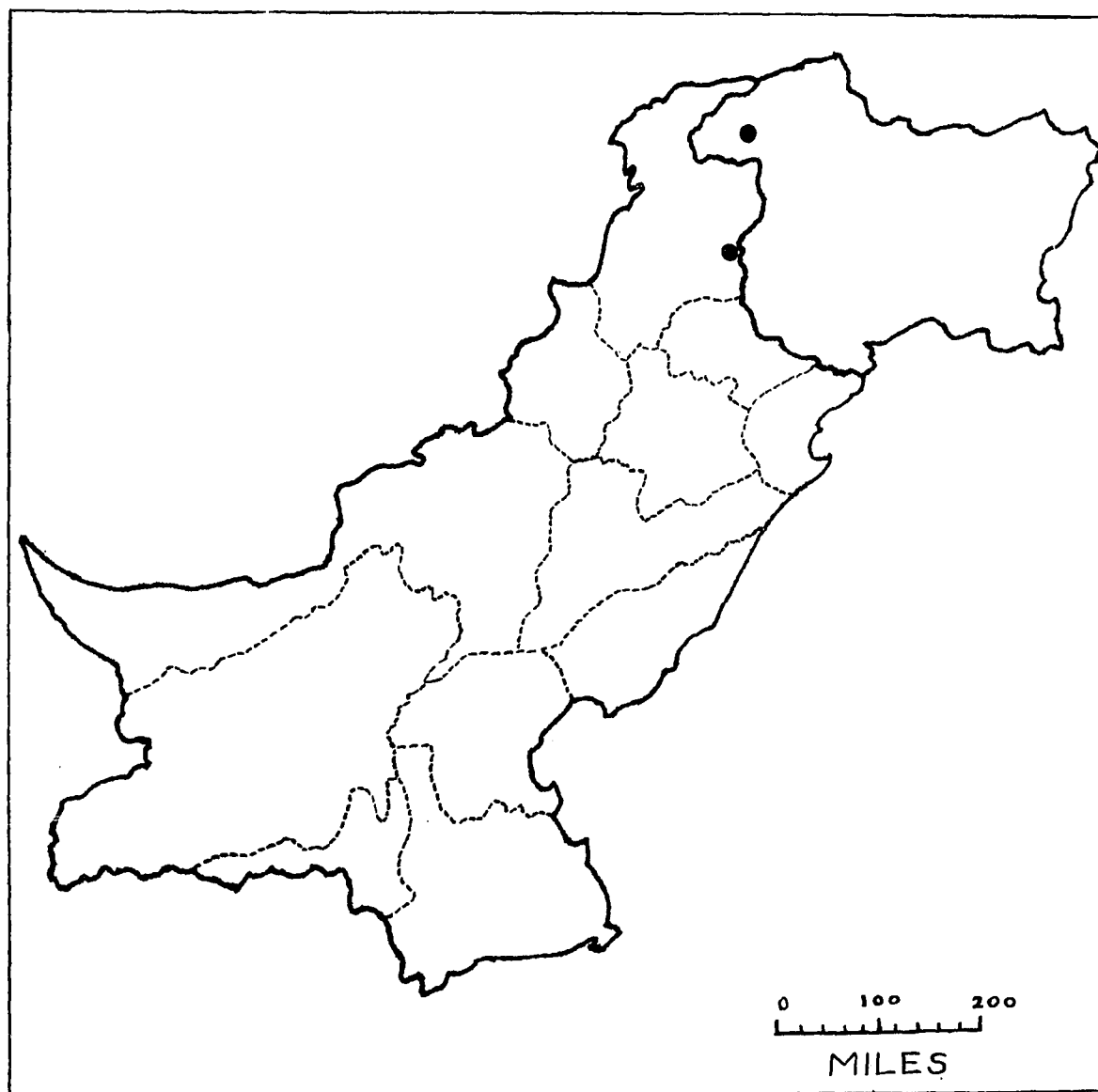


Fig. 31. Ixodes stromi Filippova, 1957. A-I, female:  
 A-scutum; B-coxae I-IV; C-capitulum, dorsal view;  
 D-capitulum, ventral view; E-tarsus I; F-tarsus IV;  
 G-genital groove; H-preanal groove; I-spiracular plate.



Map XXXIII. Ixodes stromi Filippova, 1957  
Geographical distribution — West Pakistan

## GENUS RHIPICEPHALUS KOCH, 1844

### Introduction

Sharif (1928) reported the presence of Rhipicephalus sanguineus and Rhipicephalus haemaphysaloides throughout pre-partition India, and noted the wide degree of variation in the form and structure of both species.

Recently Dhanda (1966) described a new species, R. ramachandrai, which is also found in West Pakistan.

Only one subspecies of R. haemaphysaloides has been collected in West Pakistan, but at least two subspecies of R. sanguineus are commonly found in several areas.

### Key to the Males

1. Plate on venter of palpal article 1 with three or less setae.  
Palpal article 2 with three infrainternal setae. A small,  
yellow, highly punctate tick ..... ramachandrai  
Plate on venter of palpal article 1 with five or more setae.  
Palpal article 2 with at least five infrainternal setae. Medium sized ticks, yellow brown to reddish brown, punctations  
variable..... 2
2. Adanal shields sickle-shaped, posterior margins curved medially ..... haemaphysaloides

- Adanal shields variable but straight, posterior margins variable ..... 3
3. Dorsal projections of spiracular plates with anterodistal indentations. Adanal shields with minute projections or spurs on medial margin, just posterior to the level of the anus.....  
 ..... sanguineus turanicus
- Dorsal projections of spiracular plates without anterodistal indentations. Medial margin of adanal shields without spurs or projections ..... sanguineus sanguineus

#### Key to the Females

1. Plate on venter of palpal article 1 with three or less setae.  
 Palpal article 2 with three infrainternal setae. A small, yellow, highly punctate tick ..... ramachandrai
- Plate on venter of palpal article 1 with five or more setae.  
 Palpal article 2 with at least five infrainternal setae. Medium sized ticks, yellow brown to reddish brown, punctations variable..... 2
2. Scutal punctations medium to large, sparse, shallow but distinct ..... haemaphysaloides
- Scutal punctations small to medium (with but few large punctations). Punctations numerous ..... 3
3. Posteroventral margin of spiracular plate angulated .....  
 ..... sanguineus sanguineus

Posteroventral margin of spiracular plate curved.....  
.....sanguineus turanicus

RHIPICEPHALUS HAEMAPHYSALOIDES HAEMAPHYSALOIDES

SUPINO, 1897

Synonymy

Rhipicephalus haemaphysaloides niger

Supino, 1897, Atti Soc. Veneto-Trent Sci. Nat., series 2, 3 (1):  
233.

Rhipicephalus haemaphysaloides ruber

Supino, 1897, Atti Soc. Veneto-Trent Sci. Nat., series 2, 3 (1):  
234-235.

Rhipicephalus paulopunctatus

Neumann, 1897, Mém. Soc. Zool. France, 10: 397-398, 419,  
420.

Rhipicephalus haemaphysaloides

Neumann, 1897, Mém. Soc. Zool. France, 10: 417.

Warburton, 1907, Bull. Imper. Dept. Agric. India, No. 6: 10-11.

Sharif, 1928, Rec. Indian Mus., 30 (3): 280-283.

Sen, 1938, Indian Jour. Vet. Sci. and Animal Husbandry, 8:  
133-147.

Rhipicephalus haemaphysaloides haemaphysaloides

Neumann, 1911, Das Tierreich, 26: 41.

Anastos, 1950, Ent. Amer., 30 (1-4): 59-65.

## Hosts, Distribution and Biology

Rhipicephalus haemaphysaloides haemaphysaloides has been collected in West Pakistan from cattle, sheep, goats, horses, buffalo and jackal. Collections of adults were made in May, June, July and August. Elsewhere, in addition to the above, it has been reported from pine marten, dog, bear, leopard, donkey, Bengal hare, wolf, Nemorhaedus bubalinus, Cervulus muntjac, Sus cristatus, Cervulus muntjac, Lepus simcoxi, Hemitragus hylocrius, Muntiacus muntjak vaginalis, Arctonyx collaris, Hystrix subcristatus subcristatus, Cervus unicolor, Felis viverrina, Felis tigris, Felis pardus, Gallus gallus gallus and orange-breasted flycatcher.

In West Pakistan R. h. haemaphysaloides is common in the northern hill areas and is found in isolated places through the Indus basin to the general Karachi area. Collections were made in Saidu Sharif, Naran and Mansehra in Peshawar Division, Muzaffarabad and Neelum Valley in Azad Kashmir, Panjar in Rawalpindi Division, Bajwat and Lahore in Lahore Division, Khairpur in Khairpur Division, Buhara and Karachi in Karachi Division.

This tick has been reported from India, Ceylon, Burma, China, Formosa, "Indochina" and Indonesia.

Anastos (1950) notes that the immature stages of this species are unknown and postulates that.... "this is either a two-host tick or a three-host tick spending part of its life cycle on other animals, pro-



bably small rodents or birds."

### Disease Relationship

Unknown, but suspected of a role in Indian tick typhus (Sharif, 1938).

### Description - Male (Fig. 32, A-H)

1. Body. Dark reddish brown. Ten specimens, length 2.7 mm - 4.0 mm, average 3.4 mm; width 1.5 mm - 2.3 mm, average 1.9 mm.

2. Scutum. Elongate oval, widest in posterior half. Length 2.3 mm - 3.4 mm, average 2.9 mm; width 1.5 mm - 2.2 mm, average 1.9 mm. Scapulae short and broad. Cervical grooves short and shallow, not reaching eyes. Lateral grooves long, reaching to just below eyes. Posteromedian and paramedian grooves present but shallow and sometimes indistinct. Punctations large, distinct and randomly scattered. Eyes prominent, marginal and convex.

3. Venter. Adanal shields large and broad, posterior margins medially directed, sickle shaped. Accessory anal shields small and poorly developed with pointed posterior margins. Spiracular plates elongate oval with short dorsal projections.

4. Legs. Strong and covered with long, white hairs. Coxa I with two large spurs, the inner twice as broad as the outer. Coxae II, III with short outer and rudimentary ridgelike inner spurs. Coxa IV with small but prominent inner and outer spurs.

5. Capitulum. Length 0.6 mm - 0.8 mm, average 0.7 mm;

width 0.6 mm - 0.7 mm, average 0.7 mm. Basis capituli hexagonal, twice as broad as long. Posterior margin of basis slightly concave. Cornua small and broad. Palps short and broad. Article 1 with prominent ventral plate. Inner dorsal edge of article 2 forming small spur on posterior margin.

6. Hypostome. Average length 0.3 mm, dentition 3/3, teeth small.

#### Description - Female (Fig. 32, I-P)

1. Body. Deep orange brown. Ten specimens, length 3.3 mm (unengorged) - 9.0 mm (engorged), width 1.8 mm (unengorged) - 6.5 mm (engorged).

2. Scutum. Cordiform, posterior margin wavy and bluntly pointed. Length 1.2 mm - 1.7 mm, average 1.5 mm; width 1.3 mm - 1.7 mm, average 1.5 mm. Scapulae short and broad. Cervical grooves start as deep pits, rapidly broaden, become shallow, and extend into the posterior third of the scutum. Punctations shallow and medium sized in scapular regions; large punctations prominent in cervical grooves and median regions. Eyes marginal, elongate and convex.

3. Venter. Genital aperture between coxae II, aperture U-shaped. Spiracular plates ovate, dorsal projections minute.

4. Legs. As in the male.

5. Capitulum. Length 0.7 mm - 0.8 mm, average 0.7 mm;

width 0.7 mm - 0.8 mm, average 0.8 mm. Basis capituli hexagonal. Posterior margin of basis straight, cornua minute. Porose depression of basis circular. Palps short and broad, article 1 with ventral plate, outer edge of article 2 with small lateral projection.

6. Hypostome. Average length 0.3 mm, dentition 3/3, teeth small.

### Remarks

In his work on the ticks of Indonesia Anastos (1950) considers R. haemaphysaloides second only to B. microplus as a pest of livestock and holds that it should be regarded with suspicion as a possible vector of pathogens. While this species is less common in West Pakistan, its relative frequency in northern regions and its predilection for domestic stock warrant investigation of its vector potential.

Specimens collected in West Pakistan show some variation in the degree of curvature of the adanal shields. Sharif (1928) noted the same variation in Indian species; however, identification can be made through other characters such as size, scutal shape and punctuation.

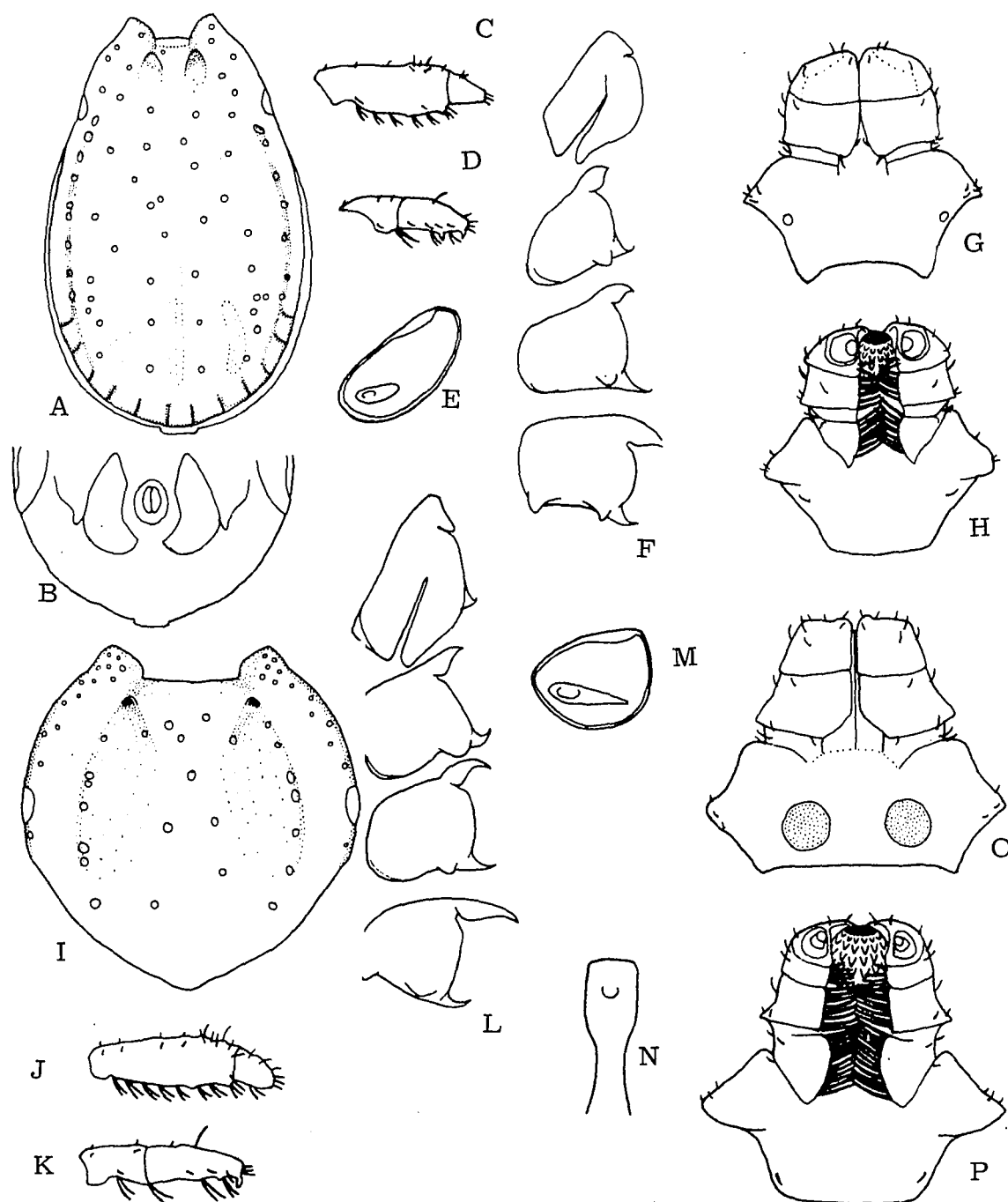
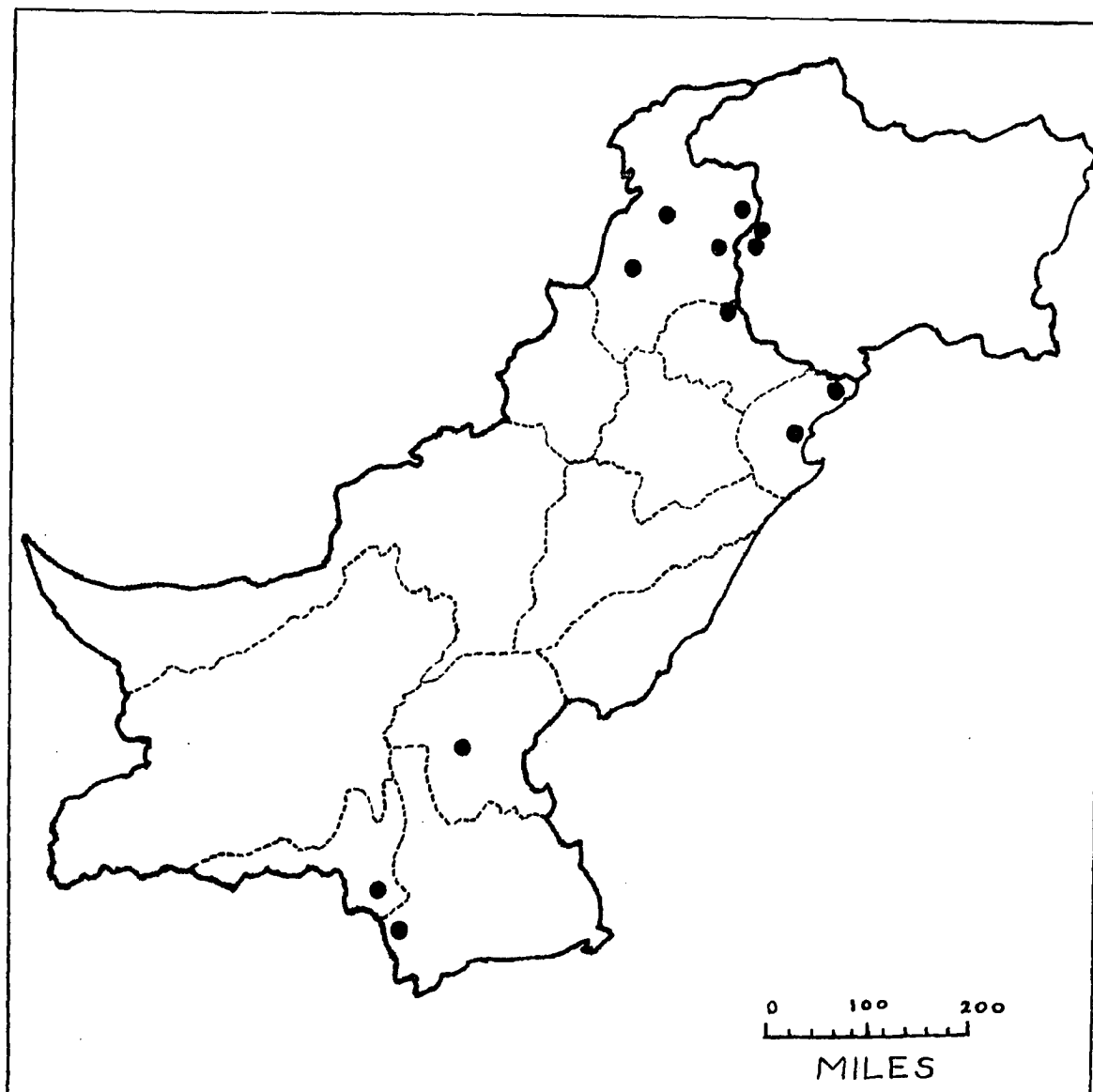


Fig. 32. Rhipicephalus haemaphysaloides haemaphysaloides Supino, 1897. A-H, male: A-scutum; B-adanal and accessory shields; C-tarsus I; D-tarsus IV; E-spiracular plate; F-coxae I-IV; G-capitulum, dorsal view; H-capitulum, ventral view. I-P, female: I-scutum; J-tarsus I; K-tarsus IV; L-coxae I-IV; M-spiracular plate; N-genital aperture; O-capitulum, dorsal view; P-capitulum, ventral view.



Map XXXIV. Rhipicephalus haemaphysaloides haemaphysaloides  
Supino, 1897  
Geographical distribution — West Pakistan

RHIPICEPHALUS RAMACHANDRAI DHANDA, 1966

Synonymy

Rhipicephalus ramachandrai

Dhanda, 1966, J. Parasit., 52 (5): 1025-1031.

Hosts, Distribution and Biology

Dhanda (1966) reported that adults of this species were found during January, March, April, June and October in the Indian states of Mysore, Maharashtra and Uttar Pradesh. All collections were from Tatera indica or its nest with the exception of one collection from a squirrel (probably Funambulus tristriatus).

In West Pakistan two collections were made from Tatera sp., one at Mansehra, Peshawar Division on 11 July 1964, the other from Changa Manga Reserve Forest, Lahore Division.

This species has not been reported outside India and Pakistan.

Disease Relationship

Unknown.

Description - Male (Fig. 33, A-H)

1. Body. Pale yellowish brown. Three specimens, length 2.1 mm - 2.4 mm, width 1.2 mm - 1.3 mm.

2. Scutum. Elongate oval, widest in posterior half. Length 1.8 mm - 2.1 mm, width 1.2 mm - 1.3 mm. Cervical grooves shallow, extending just past the level of the eyes. Lateral grooves long, extending into the anterior third of the scutum. Posteromedian and paramedian grooves present but indistinct and limited to the posterior third of the scutum. Paired circular depressions in midscutum. Fестоons poorly differentiated. Punctations small but distinct and extremely numerous, many contiguous in the lateral and cervical grooves. Eyes small, flat and indistinct, located in the anterior quarter of the scutum.

3. Venter. Pale yellow. Genital aperture between coxae II. Adanal shields large and subtriangular, inner margin with a shallow concavity, posterior and outer margins rounded. Accessory anal shields obsolescent, small, and bluntly rounded posteriorly. Spiracular plates comma-shaped.

4. Legs. Yellowish brown. Coxa I with subequal, broader, inner and narrower outer spurs. Coxae II-IV with small, broad and distinct outer spurs. Tarsi II-IV slightly humped with prominent apico-ventral hooks.

5. Capitulum. Length 0.3 mm, width 0.4 mm. Basis capituli hexagonal, posterolateral and posterior margins concave. Cornua small, wide and distinct. Palps short. Article 1 covered ventrally by a triangular plate bearing 3 feathery setae on its inner margin. Articles 2 and 3 subequal; article 2 with 2 or 3 feathery setae on inner

ventral margin, article 3 with 1 or 2 slender setae on inner ventral margin.

6. Hypostome. Short and blunt, length 0.2 mm, dentition 3/3, teeth small.

#### Description - Female (Fig. 33, I-P)

As no females have been collected in West Pakistan, the following data are taken from Dhanda (1966).

1. Body. Ten specimens, length 2.1 mm - 2.4 mm, average 2.2 mm; width 1.0 mm - 1.2 mm, average 1.1 mm (all specimens unengorged).

2. Scutum. Cordiform, widest at midlength, posterior margin bluntly rounded. Length 0.7 mm - 0.8 mm, average 0.8 mm; width 0.7 mm - 0.8 mm, average 0.8 mm. Cervical grooves distinct, outer margins concave, extending almost the entire length of the scutum. Punctations numerous, large, many contiguous. Eyes flat, marginal, on widest point of scutum.

3. Venter. Genital aperture between coxae II. Genital grooves slightly diverging posteriorly to level of spiracles; posterior to the spiracles they are almost parallel, not touching the festoons. Numerous minute setae on the ventral integument. Spiracular plates elongate oval.

4. Legs. Similar to those of the male, apicoventral hooks on tarsi II- IV feebly developed.

5. Capitulum. Length 0.3 mm - 0.4 mm, average 0.4 mm;



width 0.4 mm - 0.5 mm, average 0.5. Basis capituli much wider than that of the male. Porose depressions of the basis oval in shape, extending anteriorly almost to the base of the hypostome. Porose areas separated by a small rounded depression. Palps similar to those of the male.

6. Hypostome. Similar to that of the male.

#### Remarks

While its small size and host preference set R. ramachandrai apart from other members of this genus, it can be confused with runts of R. sanguineus. However these species can be easily differentiated by scutal punctation and the arrangement and number of inner ventral palpal setae.

The Pakistani males described in this work range up to 0.5 mm larger than the Indian material described by Dhanda. It is possible that when Pakistani females are described, they too will exceed the measurements given for the Indian populations. In their absence the illustrations used here have been copied from Dhanda (1966).

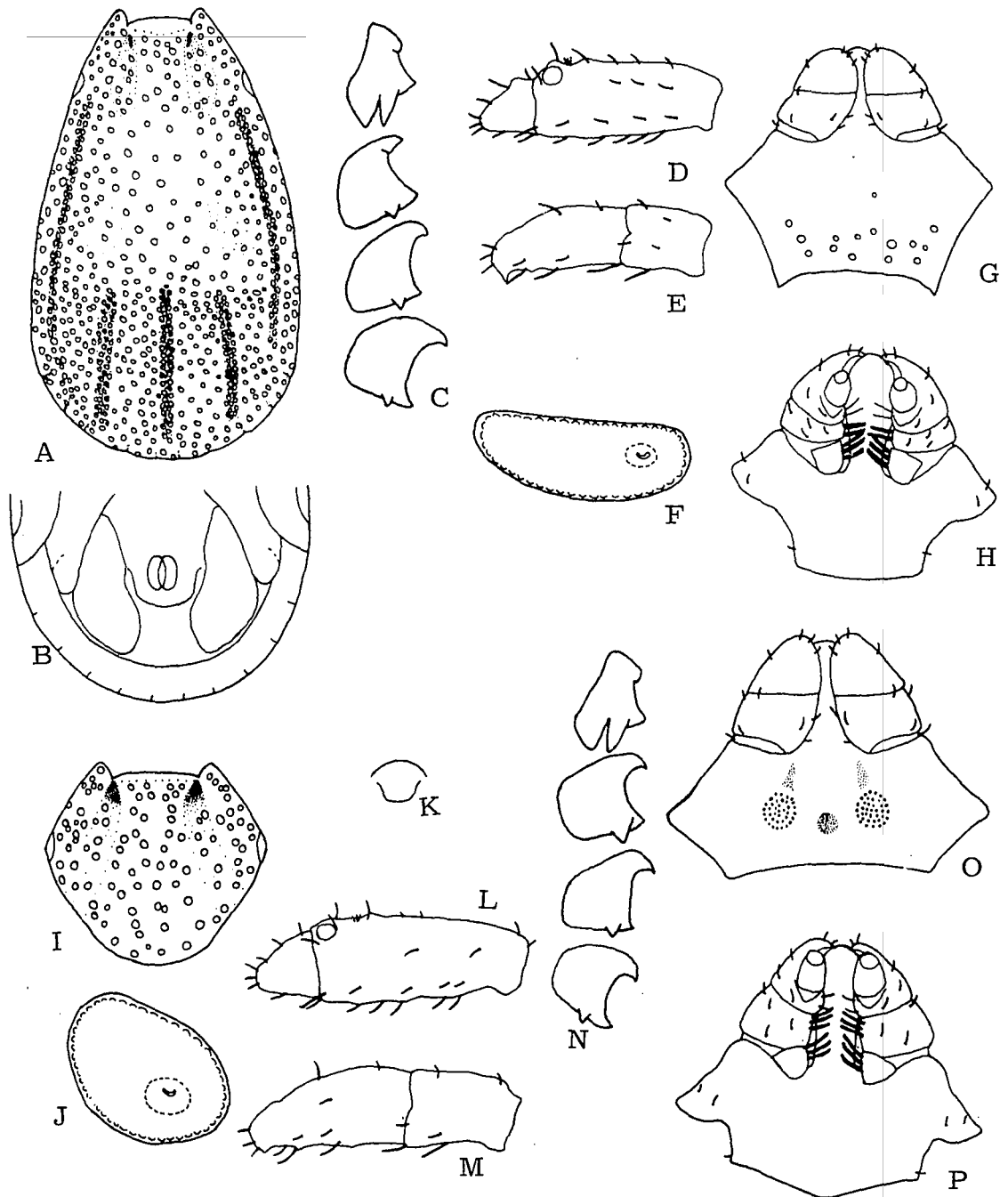
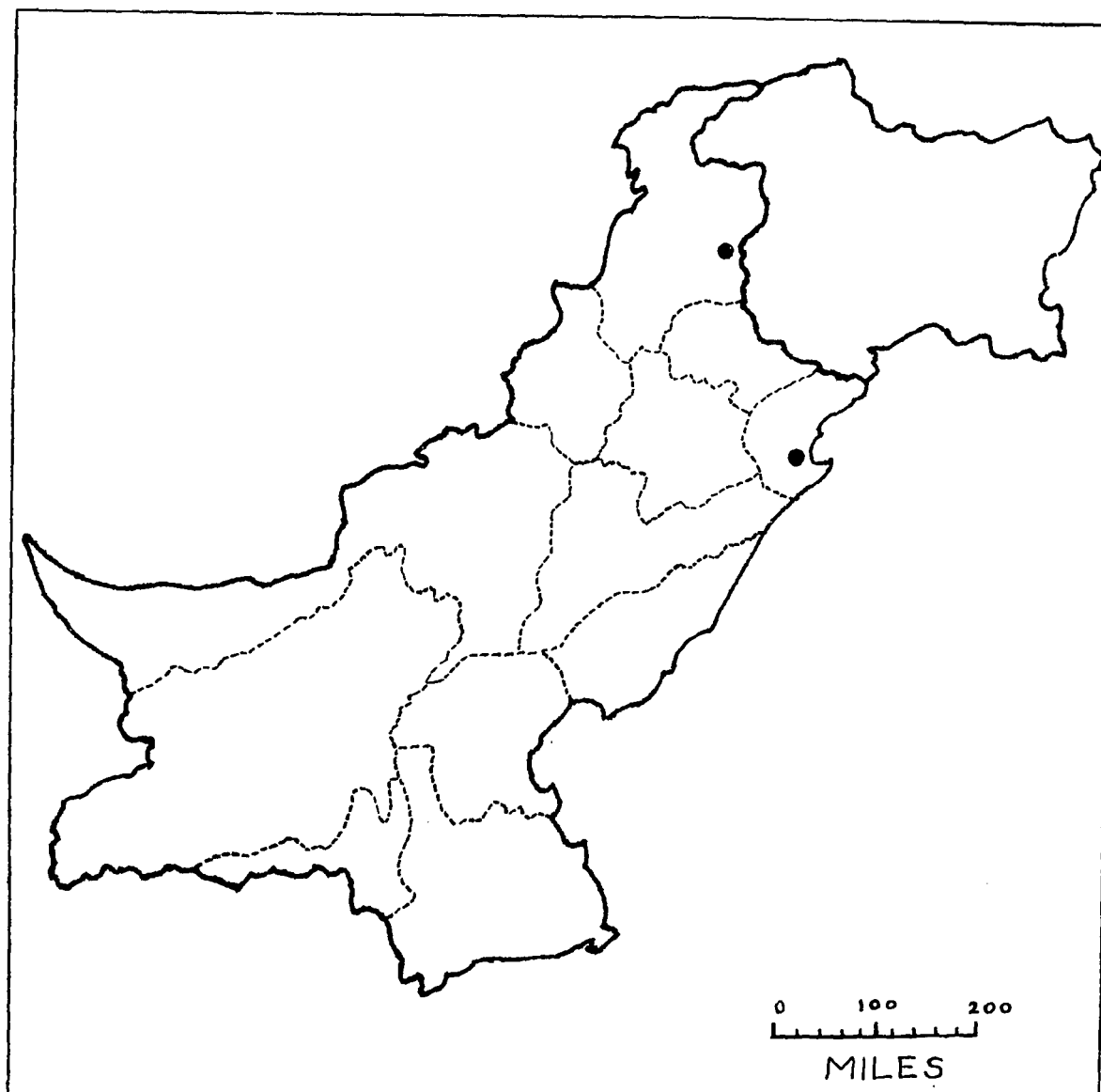


Fig. 33. Rhipicephalus ramachandrai Dhanda, 1966. A-H, male: A-scutum; B-adanal and accessory shields; C-coxae I-IV; D-tarsus I; E-tarsus IV; F-spiracular plate; G-capitulum, dorsal view; H-capitulum, ventral view. I-P, female: I-scutum; J-spiracular plate; K-genital aperture; L-tarsus I; M-tarsus IV; N-coxae I-IV; O-capitulum, dorsal view; P-capitulum, ventral view.



Map XXXV. Rhipicephalus ramachandrai Dhanda, 1966  
Geographical distribution — West Pakistan

RHIPICEPHALUS SANGUINEUS SANGUINEUS (LATREILLE, 1806)

Synonymy

Ixodes sanguineus

Latreille, 1806, Gen. Crust. et Ins., 1: 157.

Rhipicephalus sanguineus

Koch, 1844, Arch. Naturgesch., 10 (1): 238.

Sharif, 1928, Rec. Indian Mus., 30 (3): 275-279.

Sen, 1938, Indian Jour. Vet. Sci. and Animal Husbandry, 8:  
133-147.

Pomerantsev, 1950, Fauna of the USSR, 4 (2): 172-176.

Anastos, 1950, Ent. Amer., 30 (1-4): 68-71.

Anastos, 1957, U. S. Pub. Health Serv. Publ. No. 548: 224-233.

Morel and Vassiliades, 1962, Rev. Élev. Méd. Vet. Pays trop.,  
15 (4): 343-386.

Rhipicephalus sanguineus sanguineus

Neumann, 1911, Das Tierreich, 26: 35-36.

Hoogstraal, 1956, African Ixodoidea, Vol. I, Ticks of the Sudan:  
686-726.

Elbl and Anastos, 1966, Ixodid Ticks (Acarina, Ixodidae) of  
Central Africa, Vol. III: 124-133.

Rhipicephalus breviceps

Warburton, 1910, Parasitology, 3: 395-407.

## Hosts, Distribution and Biology

In West Pakistan Rhipicephalus sanguineus sanguineus is extremely common and in numbers collected it is second only to Hyalomma a. anatolicum. The most common domestic hosts are sheep, goats and dogs; occasional collections have been made from buffalo, cattle, horses and camels.

Hares, jackals and hedgehogs are the most common wild hosts. The wild host list includes Gazella gazella bennetti, Lepus capensis tibetanus, Lepus nigricollis dayanus, Lepus nigricollis ruficaudatus, Hemiechinus auritus, Hemiechinus megalotis, Paraechinus hypomelas, Canis aureus, Felis chaus, Mustela altaica, Sus scrofa cristatus, Vulpes bengalensis and Vulpes vulpes griffithi.

R. s. sanguineus has been collected in all divisions of West Pakistan, during each month of the year.

The biology of R. s. sanguineus has been studied in the laboratory by many workers. Earlier work has been summarized by Hoogstraal (1956) and Elbl and Anastos (1966). Anastos (1957) has compiled pertinent Soviet literature on this species. Much has been written on this subject, but there is an increasing amount of evidence that considerable variation exists in the biology of this subspecies. What holds true for American or African populations may or may not apply to Oriental populations. Such factors as climate and environment exert great influence on the biology of local populations. Until detailed field studies

are carried out in West Pakistan, only generalized assumptions can be made.

R. s. sanguineus is a three host tick, capable of parasitizing all species of mammals, and occasionally reported from several species of birds. Under optimum conditions it may complete its life cycle in 63 days; under less favourable conditions it may require as long as two years. Its distribution is worldwide and its most common host is the domestic dog.

#### Disease Relationship

R. s. sanguineus has been frequently indicted (but less frequently convicted) as a vector of many pathogens. But in many cases its role in nature has yet to be elucidated.

It has been reported as a vector of Rickettsia conori in Mediterranean regions and Indian tick typhus in Kashmir. It is suspected of being a vector of R. rickettsii in Mexico and the southern United States. Its role in the transmission of Coxiella burneti is not clear. While it has been found infected in nature and shown to transmit the microbe in laboratory experiments, there is no conclusive evidence that it does so in nature.

Experimental or epidemiological evidence has suggested the involvement of R. s. sanguineus with the following diseases or syndromes; tick paralysis, Japanese B encephalitis, lymphocytic choriomeningitis, kala azar, Uzbek haemorrhagic fever, yellow fever, North Queensland

tick typhus, relapsing fever, tularemia and toxoplasmosis. In all of these the evidence is either theoretical, sketchy or contradictory.

R. s. sanguineus is also involved in several diseases of lower animals. It is a vector of Rickettsia canis and Babesia canis in dogs, and Borellia theileri in sheep, goats, horses and cattle. It is also suspected in the transmission of the following: Babesia caballi, Nuttallia equi, Theileria annulata, Anaplasma marginale, Babesia bigemina, Hymenolepis microstoma, Dipletalonema grassii, Dirofilaria immitis, Dipletalonema reconditum and Salmonella enteritidis.

#### Description - Male (Fig. 34, A-H)

1. Body. Yellowish brown. Sixteen specimens, length 2.1 mm - 3.5 mm, average 2.8 mm; width 1.2 mm - 1.9 mm, average 1.5 mm. In some engorged specimens the median three festoons are extended caudally to form a blunt protrusion.

2. Scutum. Reddish brown, subovate. Length 1.8 mm - 3.0 mm, average 2.3 mm; width 1.1 mm - 1.7 mm, average 1.4 mm. Cervical grooves short and shallow, terminating above the level of the eyes. Lateral grooves long, terminating just below level of eyes. Postero-median groove wide and shallow, limited to posterior third of scutum. Paramedian grooves shallow, ovate depressions, shorter than postero-median groove. Eyes flat on scutal margins. Punctations mixed and numerous, largest punctations mainly in anterior and posterior thirds of scutum.

3. Venter. Genital aperture between coxae II. Adanal shields elongate; outer lateral margins convex, inner margins wavy, forming concavities below the level of the anus. Posterior margin of shields variable, ranging from pointed to bluntly rounded. Accessory anal shields small pointed and weakly chitinized. Spiracular plates comma-shaped, dorsal projection straight.

4. Legs. Strong. Coxa I with two subequal spurs, the outer narrow and curved, the inner wider and angular. Coxae II - IV with short rounded outer spurs, inner spurs absent or reduced to weak ridges.

5. Capitulum. Average length 0.5 mm, average width 0.6 mm. Palps short and blunt. Basis capituli hexagonal, over twice as wide as long. Cornua short and broad.

6. Hypostome. Short and blunt. Average length 0.3 mm, dentition 3/3, teeth small.

#### Description - Female (Fig. 34, I-P)

1. Body. Yellowish brown. Fourteen specimens, length 2.9 mm (unengorged) - 10.5 mm (engorged), width 1.5 mm (unengorged) - 5.8 mm (engorged).

2. Scutum. Cordiform, widest at eye level. Length 1.2 mm - 1.5 mm, average 1.3 mm; width 1.2 mm - 1.4 mm, average 1.3 mm. Cervical grooves shallow, extending into posterior third of scutum. Punctations numerous, mixed and randomly distributed. Eyes flat,



marginal and prominent.

3. Venter. Genital aperture between coxae II. Aperture U-shaped. Spiracular plates subtriangular, posteroventral margin with small angulations. Dorsal projections short and thick.

4. Legs. As in the male.

5. Capitulum. Average length 0.6 mm, average width 0.7 mm. Porose depressions of basis small and subcircular, otherwise similar to that of the male.

6. Hypostome. Short, blunt. Average length 0.4 mm. Dentition 3/3, teeth small.

#### Remarks

The worldwide distribution and high degree of variation found in populations of this species have raised many, as yet unanswered, questions. The most recent works on the R. sanguineus complex are those of Morel and Vassiliades (1962), and Elbl and Anastos (1966) which deal mainly with African populations. Work on Pak-Indian populations is mainly limited to that of Sharif (1928) and Sapre (1944).

Warburton (1910) has described Rhipicephalus breviceps from a single ♀ collected in Sind. Most workers now feel that this is a synonym of R. sanguineus.

Sharif (1928) and Sen (1938) have probably included specimens of R. s. turanicus in their listings of R. sanguineus. This point is discussed in the "Remarks" concerning that subspecies.

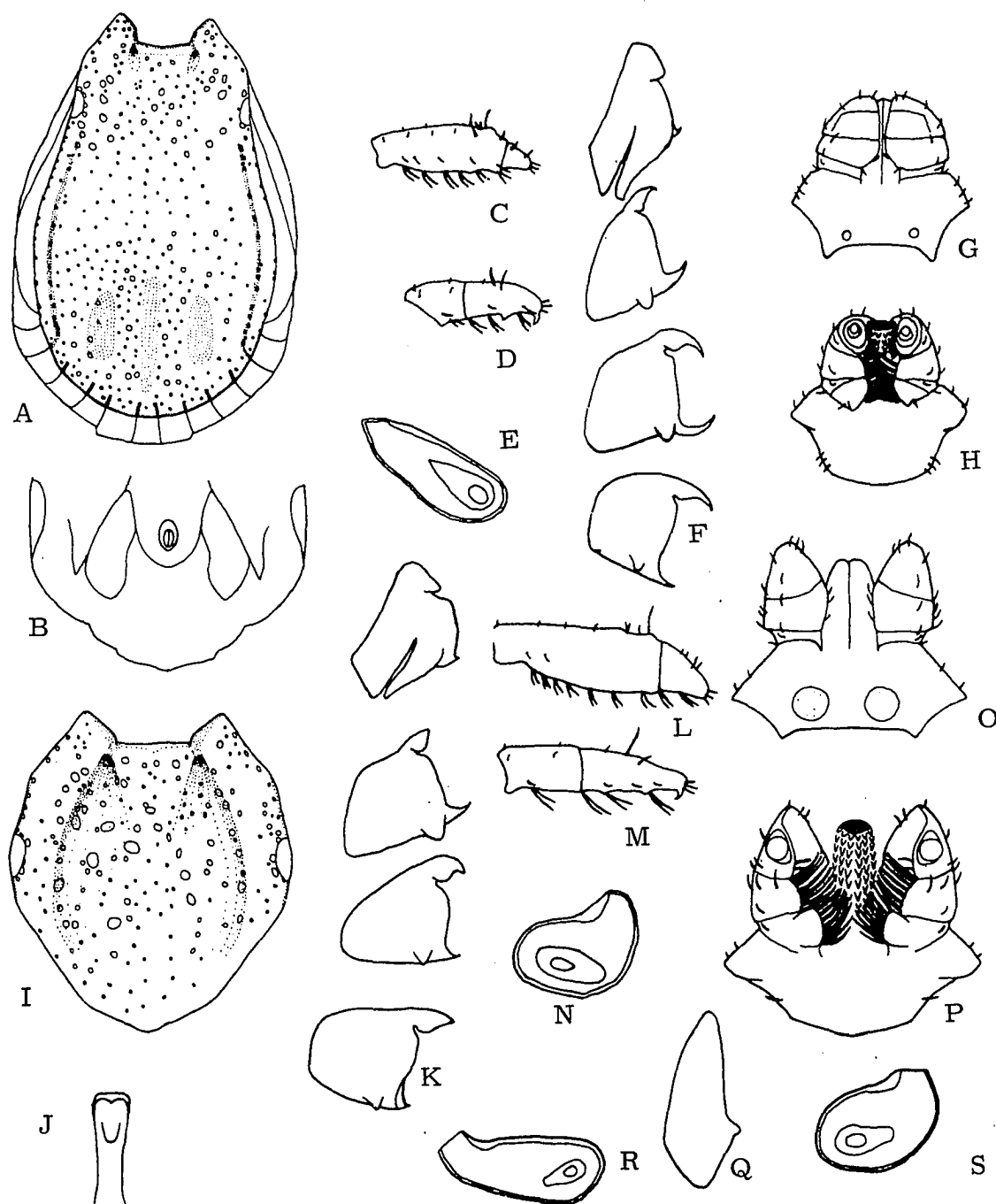
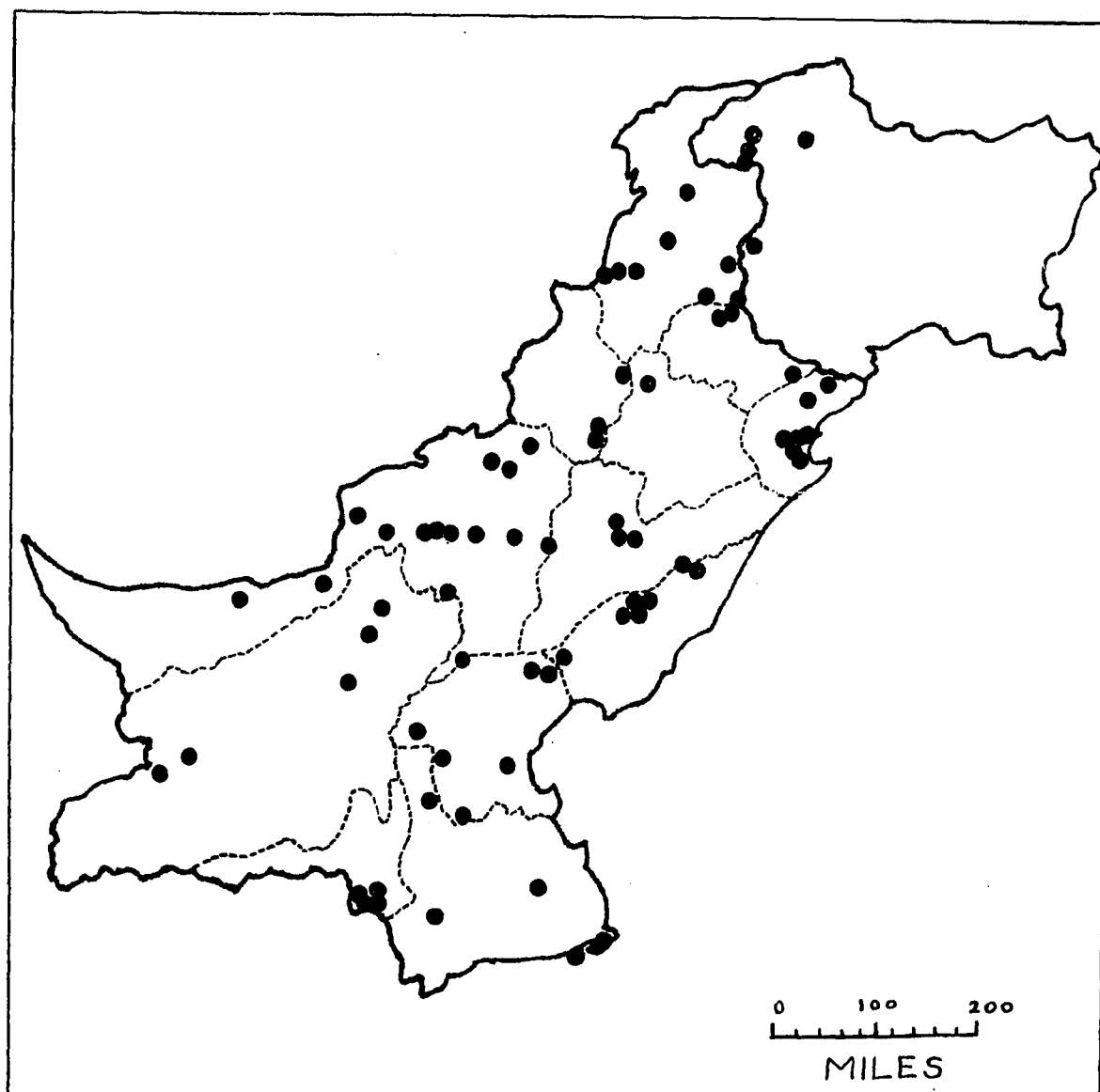


Fig. 34. Rhipicephalus sanguineus sanguineus (Latreille, 1806). A-H, male: A-scutum; B-adanal and accessory shields; C-tarsus I; D-tarsus IV; E-spiracular plate; F-coxae I-IV; G-capitulum, dorsal view; H-capitulum, ventral view. I-P, female: I-scutum; J-genital aperture; K-coxae I-IV; L-tarsus I; M-tarsus IV; N-spiracular plate; O-capitulum, dorsal view; P-capitulum, ventral view. Rhipicephalus sanguineus turanicus Pomerantsev and Matikashvili, 1940. Q-R, male: Q-adanal shield; R-spiracular plate. S-female spiracular plate.



Map XXXVI. Rhipicephalus sanguineus sanguineus (Latreille, 1806)  
Geographical distribution — West Pakistan

RHIPICEPHALUS SANGUINEUS TURANICUS

POMERANTSEV and MATIKASHVILI, 1940

Synonymy

Rhipicephalus sanguineus

Sharif, 1928, Rec. Indian Mus., 30 (3): 275-279 (in part).

Sen, 1938, Indian Jour. Vet. Sci. and Animal Husbandry, 8:  
133-147 (in part).

Zumpt, 1950, Doc. Mocambique, (60): 57-125 (in part).

Anastos, 1957, U. S. Pub. Health Serv. Publ. No. 548: 224-233  
(in part).

Rhipicephalus turanicus

Pomerantsev, Matikashvili and Lototski, 1940, Parazitol.

Sborn., 7: 100-133.

Pomerantsev, 1950, Fauna of the USSR, 4 (2): 176-179.

Morel and Vassiliades, 1962, Rev. Élev. Méd. Vet. Pays trop.,  
15 (4): 343-386.

Rhipicephalus secundus

Feldman-Muhsam, 1952, Bull. Res. Counc. Israel, 2: 187-194.

Hosts, Distribution and Biology

The host list for Rhipicephalus sanguineus turanicus is nearly as

long as that of R. s. sanguineus. Adults parasitize virtually all domestic mammals and a wide variety of wild animals. Immature stages have been collected from Vormella sarmatica, Cricetulus migratorius, Microtus nivalis, Crocidura russula, Apodemus sylvaticus and Apodemus flavicollis.

In West Pakistan adults have been collected most commonly from domestic sheep and Lepus nigricollis. Single collections have been made from a domestic goat, Vulpes bengalensis and Paraechinus hypomelas blanfordi.

R. s. turanicus has been reported from France, Italy, Bulgaria, Greece, Albania, northern Africa, Israel, Syria, Iraq, Iran, China and the Soviet Union. In West Pakistan it has been collected near Bela in Karachi Division, Mansehra in Peshawar Division, Kalabagh in Sargodha Division, Jacobabad in Khairpur Division, D. I. Khan in D. I. Khan Division and several areas around Lahore in Lahore Division.

Pomerantsev (1950) cites several workers in pointing out that "R. turanicus" may have either a two host or a three host type of development and postulates that the entire cycle in nature is apparently completed within one year. In the Soviet Union adults are found on animals from February to the end of September. The highest level of parasitism occurs in May. Morel and Vassiliades (1962) note that in Africa two seasonal peaks are reached, one from March to May, the other from September to November. This subspecies appears to be most common in deserts and dry subtropical regions up to an elevation of

3,000 feet.

### Disease Relationship

Dr. Charles Wisseman of Maryland U. has isolated a rickettsial agent of the "spotted fever group" from R. s. turanicus collected off a domestic goat in the town of Gilgit, Gilgit (personal communication).

In the Soviet Union R. s. turanicus transmits piroplasmosis of swine and nuttalliosis of horses (Pomerantsev, 1950).

### Description - Male (Fig. 34, Q-R)

1. Body. Yellowish brown. Ten specimens, length 3.0 mm - 3.8 mm, average 3.5 mm; width 1.8 mm - 2.6 mm, average 2.1 mm. Engorged specimens frequently have a caudal protrusion formed by the extension of the median festoons.

2. Scutum. Reddish brown Length 1.8 mm - 2.6 mm, average 2.1 mm; width 1.5 mm - 2.0 mm, average 1.7 mm. Grooves, eyes and punctations similar to those of R. s. sanguineus.

3. Venter. Genital aperture between coxae II. Adanal shields three times longer than wide and generally similar to R. s. sanguineus; but each has a small hillock or spur on the inner margin, slightly below the level of the anal opening. The accessory anals are small, pointed and weakly chitinized. The spiracular plates are comma-shaped and the dorsal projections are slightly wider than those of R. s. sanguineus; the dorsal projection is curved dorsally near the distal end, giv-

ing the dorsal margin an indented appearance as it approaches the scutum.

4. Legs. As in R. s. sanguineus.
5. Capitulum. As in R. s. sanguineus.
6. Hypostome. As in R. s. sanguineus.

#### Description - Female (Fig. 34, S)

1. Body. Yellowish brown. Twelve specimens, length 2.6 mm (unengorged) - 13.0 mm (engorged), width 1.4 mm (unengorged) - 8.3 mm (engorged).
2. Scutum. As in R. s. sanguineus.
3. Venter. Similar to R. s. sanguineus with the exception that the posteroventral margins of the spiracular plates are curved (not angulated).
4. Legs. As in R. s. sanguineus.
5. Capitulum. As in R. s. sanguineus.
6. Hypostome. As in R. s. sanguineus.

#### Remarks

Pomerantsev, et al., (1940) described R. turanicus and separated it from R. sanguineus by the shape of the spiracular plates and the presence or absence of spurs on the adanal shields. Morel and Vassiliades (1962) have accepted the validity of R. turanicus and consider R. secundus to be a synonym of it. In doing so they have ignored the work

of Pervomaisky (1954), who questioned the status of R. turanicus. Pervomaisky noted that in populations of R. turanicus a number of ticks fit the systematic criteria for R. sanguineus; likewise populations of R. sanguineus revealed individuals fitting the criteria for R. turanicus. The presence of intermediate forms was also noted. Pervomaisky then bred typical specimens of R. sanguineus with typical specimens of R. turanicus and found that they easily interbreed and produce fertile progeny.

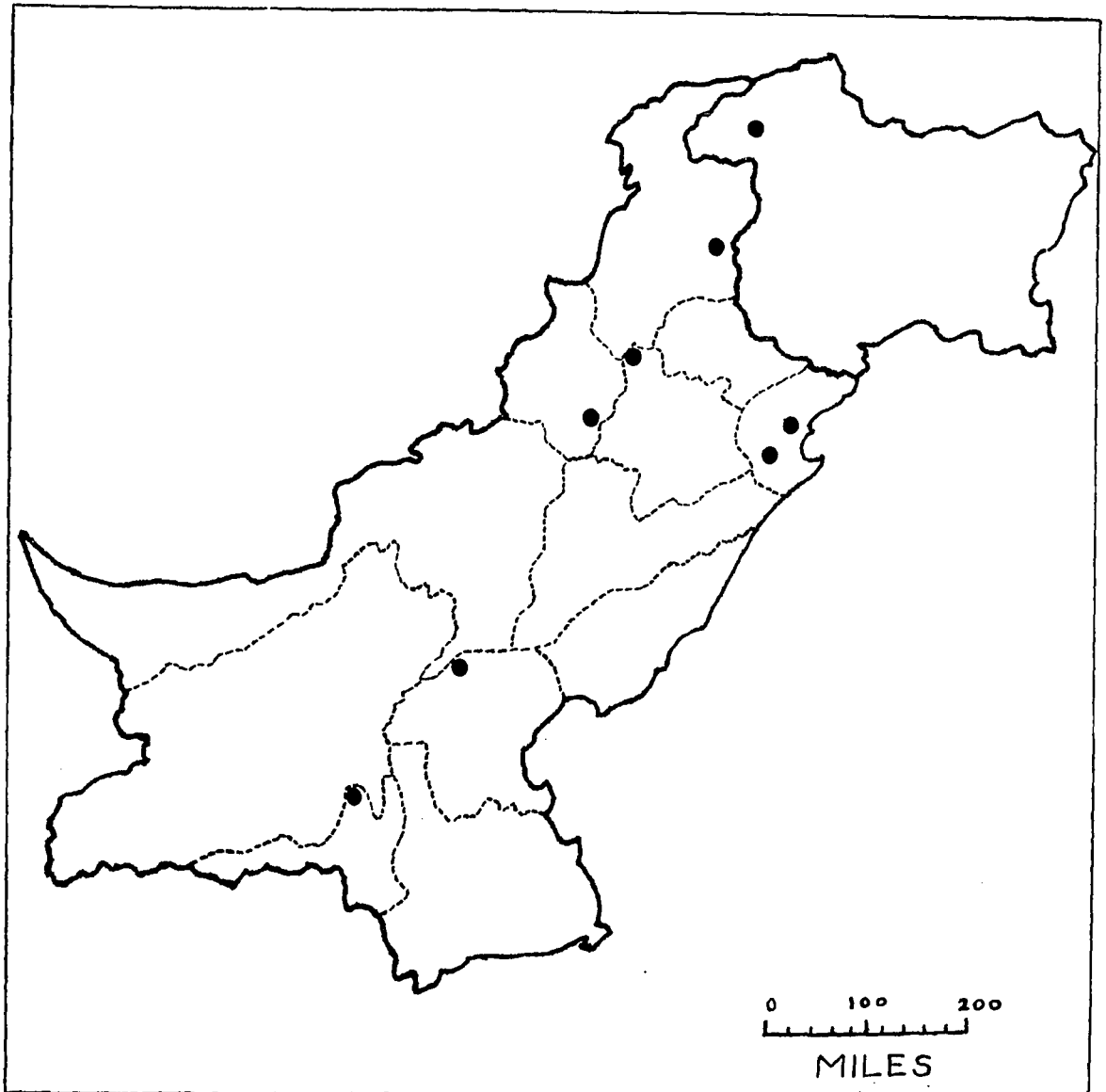
On the basis of the above work and observations in West Pakistan it appears that turanicus should be considered a subspecies of sanguineus, rather than an independent species.

It is possible that Sharif (1928) and Sen (1938) have included turanicus in their listings of R. sanguineus. In this work intermediate forms have been grouped with R. s. sanguineus. Thus the distribution and hosts for R. s. turanicus in West Pakistan are probably more extensive than stated.

The isolation of a rickettsial agent in R. s. turanicus from Gilgit raises the question of the identity of the subspecies of R. sanguineus involved with the transmission of Indian tick typhus in Kashmir. This question cannot be answered at present.

Illustrations of pertinent structures of R. s. turanicus are included with the illustrations of R. s. sanguineus.





Map XXXVII. Rhipicephalus sanguineus turanicus Pomerantsev and Matikashvili, 1940  
Geographical distribution — West Pakistan

## APPENDIX A

### DISTRIBUTION OF TICK SPECIES BY ADMINISTRATIVE DIVISION

## DISTRIBUTION ACCORDING TO ADMINISTRATIVE DIVISIONS

1. Bahawalpur: Boophilus microplus, Hyalomma anatolicum anatolicum, Hyalomma detritum, Hyalomma dromedarii, Hyalomma impeltatum, Hyalomma marginatum isaaci, Hyalomma marginatum turanicum, Rhipicephalus sanguineus sanguineus.
2. Dera Ismail Khan: Haemaphysalis leachii, Haemaphysalis sulcata, Hyalomma anatolicum anatolicum, Hyalomma dromedarii, Hyalomma marginatum isaaci, Hyalomma marginatum turanicum, Rhipicephalus sanguineus sanguineus, Rhipicephalus sanguineus turanicus.
3. Hyderabad: Boophilus annulatus, Boophilus microplus, Haemaphysalis intermedia, Haemaphysalis kutchensis, Haemaphysalis leachii, Haemaphysalis sulcata, Hyalomma hussaini, Hyalomma kumari, Hyalomma anatolicum anatolicum, Hyalomma dromedarii, Hyalomma marginatum isaaci, Rhipicephalus sanguineus sanguineus.
4. Kalat: Haemaphysalis erinacei turanica, Hyalomma anatolicum anatolicum, Hyalomma anatolicum excavatum, Hyalomma asiaticum asiaticum, Hyalomma detritum, Hyalomma dromedarii, Hyalomma marginatum isaaci, Hyalomma marginatum turanicum, Hyalomma schulzei, Rhipicephalus sanguineus sanguineus.
5. Karachi: Amblyomma javanense, Aponomma gervaisii, Boophilus

- annulatus, Boophilus microplus, Hyalomma brevipunctata, Hyalomma anatolicum anatolicum, Hyalomma detritum, Hyalomma dromedarii, Hyalomma marginatum isaaci, Hyalomma marginatum turanicum, Rhipicephalus haemaphysaloides haemaphysaloides, Rhipicephalus sanguineus sanguineus, Rhipicephalus sanguineus turanicus.
6. Khairpur: Boophilus annulatus, Haemaphysalis bispinosa, Haemaphysalis kutchensis, Hyalomma anatolicum anatolicum, Hyalomma detritum, Hyalomma dromedarii, Hyalomma marginatum isaaci, Rhipicephalus haemaphysaloides haemaphysaloides, Rhipicephalus sanguineus sanguineus, Rhipicephalus sanguineus turanicus.
7. Lahore: Aponomma gervaisii, Boophilus annulatus, Boophilus microplus, Haemaphysalis kutchensis, Haemaphysalis leachii, Haemaphysalis montgomeryi, Hyalomma anatolicum anatolicum, Hyalomma detritum, Hyalomma dromedarii, Hyalomma kumari, Hyalomma marginatum isaaci, Rhipicephalus haemaphysaloides haemaphysaloides, Rhipicephalus ramachandrai, Rhipicephalus sanguineus sanguineus, Rhipicephalus sanguineus turanicus.
8. Multan: Amblyomma javanense, Aponomma gervaisii, Boophilus annulatus, Boophilus microplus, Hyalomma anatolicum anatolicum, Hyalomma detritum, Hyalomma dromedarii, Hyalomma marginatum isaaci, Hyalomma marginatum turanicum, Rhipicephalus sanguineus sanguineus.
9. Peshawar: Boophilus annulatus, Boophilus microplus, Haemaphys-

- salis cornupunctata, Haemaphysalis erinacei turanica, Haemaphysalis howletti, Haemaphysalis kashmirensis, Haemaphysalis leachii, Haemaphysalis montgomeryi, Haemaphysalis sulcata, Hyalomma anatolicum anatolicum, Hyalomma asiaticum asiaticum, Hyalomma detritum, Hyalomma dromedarii, Hyalomma marginatum isaaci, Hyalomma marginatum turanicum, Ixodes persulcatus kaschmiricus, Ixodes redikorzevi redikorzevi, Ixodes stromi, Rhipicephalus haemaphysaloides haemaphysaloides, Rhipicephalus ramachandrai, Rhipicephalus sanguineus sanguineus, Rhipicephalus sanguineus turanicus.
10. Quetta: Boophilus microplus, Dermacentor raskemensis, Haemaphysalis erinacei turanica, Haemaphysalis howletti, Haemaphysalis leachii, Haemaphysalis sulcata, Hyalomma aegyptium, Hyalomma anatolicum anatolicum, Hyalomma anatolicum excavatum, Hyalomma asiaticum asiaticum, Hyalomma detritum, Hyalomma dromedarii, Hyalomma marginatum isaaci, Hyalomma marginatum turanicum, Hyalomma schulzei, Rhipicephalus sanguineus sanguineus.
11. Rawalpindi: Amblyomma javanense, Boophilus microplus, Haemaphysalis erinacei turanica, Haemaphysalis howletti, Haemaphysalis leachii, Haemaphysalis montgomeryi, Haemaphysalis sulcata, Hyalomma kumari, Hyalomma anatolicum anatolicum, Hyalomma detritum, Hyalomma dromedarii, Hyalomma marginatum isacci, Rhipicephalus haemaphysaloides haemaphysaloides,

Rhipicephalus sanguineus sanguineus.

12. Sargodha: Boophilus microplus, Haemaphysalis kutchensis, Hyalomma anatolicum anatolicum, Hyalomma detritum, Hyalomma dromedarii, Hyalomma marginatum isaaci, Rhipicephalus sanguineus sanguineus, Rhipicephalus sanguineus turanicus.
13. Azad Kashmir: Boophilus microplus, Haemaphysalis bispinosa, Haemaphysalis montgomeryi, Hyalomma anatolicum anatolicum, Hyalomma marginatum isaaci, Rhipicephalus haemaphysaloides haemaphysaloides, Rhipicephalus sanguineus sanguineus.

## APPENDIX B

### DISTRIBUTION OF TICK SPECIES

#### ACCORDING TO HOSTS

## DISTRIBUTION ACCORDING TO HOSTS

## AVES

## ORDER GALLIFORMES:

## Family Phasianidae:

Alectoris graeca koroviakovi:Hyalomma marginatum isaaciFrancolinus pondicerianus:Haemaphysalis intermedia

## ORDER PASSERIFORMES:

## Family Corvidae:

Nucifraga caryocatactes multipunctata:Haemaphysalis montgomeryi

## ORDER STRIGIFORMES:

## Family Strigidae:

Centropus sinensis:Haemaphysalis kutchensis, Hyalomma anatolicum  
anatolicum



## MAMMALIA

## ORDER ARTIODACTYLA:

## Family Bovidae:

Bos indicus (domestic):

Boophilus annulatus, Boophilus microplus, Haemaphysalis bispinosa, Haemaphysalis montgomeryi,  
Hyalomma anatolicum anatolicum, Hyalomma anatolicum excavatum, Hyalomma asiaticum asiaticum,  
Hyalomma detritum, Hyalomma dromedarii, Hyalomma hussaini, Hyalomma marginatum isaaci, Hyalomma marginatum turanicum, Rhipicephalus haemaphysaloides haemaphysaloides, Rhipicephalus sanguineus sanguineus

Boselaphus tragocamelus:

Hyalomma anatolicum anatolicum

Bubalus bubalis (domestic):

Boophilus annulatus, Boophilus microplus, Haemaphysalis montgomeryi, Hyalomma anatolicum anatolicum, Hyalomma detritum, Hyalomma dromedarii,  
Hyalomma marginatum isaaci, Hyalomma marginatum turanicum, Rhipicephalus haemaphysaloides haemaphysaloides, Rhipicephalus sanguineus sanguineus

Capra hircus (domestic):

Boophilus annulatus, Boophilus microplus, Dermacentor raskemensis, Haemaphysalis bispinosa,  
Haemaphysalis kashmirensis, Haemaphysalis montgomeryi, Hyalomma anatolicum anatolicum, Hyalomma asiaticum asiaticum, Hyalomma detritum,  
Hyalomma dromedarii, Hyalomma kumari, Hyalomma marginatum isaaci, Hyalomma marginatum turanicum,  
Rhipicephalus haemaphysaloides haemaphysaloides,  
Rhipicephalus sanguineus sanguineus, Rhipicephalus sanguineus turanicus

Capra hircus blythi:

Haemaphysalis sulcata, Hyalomma kumari

Gazella gazella bennetti:

Hyalomma dromedarii, Hyalomma marginatum isaaci,  
Rhipicephalus sanguineus sanguineus

Ovis aries (domestic):

Boophilus microplus, Dermacentor raskemensis,  
Haemaphysalis cornupunctata, Haemaphysalis kashmirensis, Haemaphysalis montgomeryi, Haemaphysalis sulcata, Hyalomma anatolicum anatolicum, Hyalomma anatolicum excavatum, Hyalomma asiaticum asiaticum, Hyalomma dromedarii, Hyalomma impetatum, Hyalomma marginatum isaaci, Hyalomma marginatum turanicum, Rhipicephalus haemaphysa-

loides haemaphysaloides, Rhipicephalus sanguineus  
sanguineus, Rhipicephalus sanguineus turanicus

Ovis orientalis punjabensis:

Haemaphysalis sulcata

Family Camelidae:

Camelus dromedarius (domestic):

Hyalomma anatolicum anatolicum, Hyalomma anatolicum excavatum, Hyalomma asiaticum asiaticum, Hyalomma detritum, Hyalomma dromedarii, Hyalomma marginatum isaaci, Hyalomma marginatum turanicum,  
Hyalomma schulzei, Rhipicephalus sanguineus sanguineus

Family Cervidae:

Axis porcinus porcinus:

Haemaphysalis bispinosa

Family Suidae:

Sus scrofa cristatus:

Haemaphysalis bispinosa, Hyalomma dromedarii,  
Hyalomma marginatum isaaci, Rhipicephalus sanguineus sanguineus

ORDER CARNIVORA:

Family Canidae:

Canis aureus:

Haemaphysalis leachii, Hyalomma anatolicum anatolicum, Rhipicephalus haemaphysaloides haemaphysaloides, Rhipicephalus sanguineus sanguineus

Canis familiaris (domestic):

Boophilus microplus, Haemaphysalis montgomeryi,  
Rhipicephalus sanguineus sanguineus

Vulpes bengalensis:

Haemaphysalis leachii, Hyalomma anatolicum anatolicum, Hyalomma dromedarii, Rhipicephalus sanguineus sanguineus, Rhipicephalus sanguineus turanicus

Vulpes vulpes griffithi:

Rhipicephalus sanguineus sanguineus

Family Felidae:

Felis chaus:

Hyalomma anatolicum anatolicum, Rhipicephalus sanguineus sanguineus

Family Mustelidae:

Martes sp.:

Ixodes persulcatus kaschmiricus

Mustela altaica:

Rhipicephalus sanguineus sanguineus

Family Viverridae:

Herpestes auropunctatus:

Haemaphysalis leachii, Hyalomma anatolicum anatolicum

cum

Herpestes edwardsi:

Haemaphysalis leachii

# ORDER INSECTIVORA:

Family Erinaceidae:

Hemiechinus auritus:

Rhipicephalus sanguineus sanguineus

Hemiechinus megalotis:

Haemaphysalis erinacei turanica, Hyalomma asiaticum

asiaticum, Rhipicephalus sanguineus sanguineus

Paraechinus hypomelas:

Rhipicephalus sanguineus sanguineus

Paraechinus hypomelas blanfordi:

Hyalomma anatolicum anatolicum, Rhipicephalus san-

guineus sanguineus, Rhipicephalus sanguineus turan-

icus

# ORDER LAGOMORPHA:

Family Leporidae:

Lepus capensis tibetanus:

Hyalomma anatolicum anatolicum, Hyalomma margina-

tum turanicum, Rhipicephalus sanguineus sanguineus

Lepus nigricollis:

Boophilus microplus, Haemaphysalis bispinosa,  
Haemaphysalis kutchensis, Hyalomma anatolicum  
anatolicum, Rhipicephalus sanguineus sanguineus,  
Rhipicephalus sanguineus turanicus

Lepus nigricollis dayanus:

Haemaphysalis kutchensis, Rhipicephalus sanguineus  
sanguineus, Rhipicephalus sanguineus turanicus

Lepus nigricollis ruficaudatus:

Rhipicephalus sanguineus sanguineus

Family Ochotonidae:

Ochotona royali:

Boophilus microplus

## ORDER PERISSODACTYLA:

Family Equidae:

Equus caballus (domestic):

Hyalomma anatolicum anatolicum, Hyalomma detritum,  
Hyalomma dromedarii, Hyalomma hussaini, Rhipiceph-  
alus haemaphysaloides haemaphysaloides, Rhipiceph-  
alus sanguineus sanguineus

## ORDER PHOLIDOTA:

Family Manidae:

Manis crassicaudata:

Amblyomma javanense

## ORDER RODENTIA:

## Family Cricetidae:

Alticola sp.:Ixodes redikorzevi redikorzevi, Ixodes stromiCricetulus sp.:Ixodes stromiTatera sp.:Rhipicephalus ramachandrai

## Family Muridae:

Apodemus sp.:Ixodes stromiRattus sp.:Ixodes redikorzevi redikorzevi

## Family Sciuridae:

Marmota caudata caudata:Haemaphysalis montgomeryi

## REPTILIA

## ORDER CHELONIA:

## Family testudinidae:

Testudo elongata:

Hyalomma aegyptium

ORDER SQUAMATA:

Family Agamidae:

Agama tuberculata:

Haemaphysalis sulcata

Family Varanidae:

Varanus monitor:

Aponomma gervaisii



## APPENDIX C

### MATERIAL EXAMINED AND IDENTIFIED

Distribution:

West Pakistan

TABLE 1. Material examined and identified as Amblyomma javanense (Supino, 1897).  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 92	18 Jan 1962	Rawalpindi	Gujrat District	<u>Manis crassi-caudata</u>	1♂, 1♀	Z. B. Mirza
C 173	20 Feb 1963	"	60 mi. W. of Jhelum	"	15♂, 3♀	A. B. Mirza
C 178	20 Feb 1963	"	"	"	14♂	"
C 543	11 Mar 1964	"	Jhelum District	"	6♂, 1♀	Traub Group
C 557	24 Mar 1964	"	"	"	5♂	"
C 564	11 Mar 1964	"	"	"	12♂	"
C 642	7 May 1964	"	"	"	5♂	"
C 643	7 May 1964	"	"	"	6♂, 1♀	"
C 644	28 Apr 1964	"	"	"	23♂, 6♀	"
C 645	17 Apr 1964	"	"	"	35♂, 3♀	"
C 646	22 Apr 1964	"	"	"	35♂, 2♀	"

TABLE 2. Material examined and identified as Aponomma gervaisii (Lucas, 1847).  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 179	10 Feb 1963	Lahore	Lahore Area	<u>Varanus monitor</u>	4♂	A. B. Mirza
C 180	10 Feb 1963	"	"	"	11♂, 1♀	"
C 181	10 Feb 1963	"	"	"	11♂, 1♀	"
C 182	12 Feb 1963	"	"	"	2♂	"
C 183	11 Feb 1963	"	"	"	7♂	"
C 184	10 Feb 1963	"	"	"	18♂, 6♀	"
C 282	18 May 1963	"	"	"	47♂, 20♀	Jan Mohd.
C 339	17 July 1963	Multan	65 mi. N. E. of Muzaffargarh	"	15♂, 4♀	Z. B. Mirza
C 874	10 July 1964	Lahore	Model Town, Lahore	"	12♂, 2♀	"
C 1130	28 Nov 1963	"	13 mi. E. of Lahore	"	24♂, 10♀	Nazeer M. Khan

TABLE 2. Material examined and identified as Aponomma gervaisii (Lucas, 1847).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1365	19 July 1964	Lahore	4 mi. from Balloki H. W. on Lower Bari Doab Canal	<u>Varanus monitor</u>	65♂, 12♀	Nazeer M. Khan

TABLE 3. Material examined and identified as Boophilus annulatus (Say, 1821).  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 60	2 Feb 1963	Hyderabad	Red Sindhi cattle farm, Tando Mohd. Khan	<u>Bos indicus</u>	1♀	V. C. McCarthy and Z. B. Mirza
C 76A	17 Feb 1963	Khairpur	Veriamabad (Jacobabad)	"	2♀	"
C 96C	13 Mar 1963	Lahore	Lalu Khichi (Balloki Headworks) 40 mi. from Lahore	<u>Bubalus bubalis</u>	1♂	"
C 118C	23 Mar 1963	D. I. Khan	D. I. Khan	<u>Capra hircus</u>	1♀	"
C 256A	10 May 1963	Karachi	Sonmiani Beach Area, 32 mi. W. of Karachi	<u>Bubalus bubalis</u>	2♂, 3♀	"
C 259A	10 May 1963	"	Hub, 11 mi. W. of Karachi	<u>Bos indicus</u>	1♂, 2♀	"

TABLE 3. Material examined and identified as Boophilus annulatus (Say, 1821).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 260A	11 May 1963	Karachi	24 mi. ENE of Karachi on Thano Bula Khan Rd.	<u>Capra hircus</u>	3♂, 4♀	V. C. McCarthy and Z. B. Mirza
C 275A	16 May 1963	Multan	7 mi. W. of Muzaffargarh on D. G. Khan Rd.	"	1♂	"
C 311A	3 June 1963	Peshawar	8 mi. N. of Mansehra	<u>Bos indicus</u>	1♂	"
C 398A	4 Aug 1963	Karachi	Bela	<u>Bos indicus</u>	1♂, 1♀	Z. B. Mirza
C 479	24 Sept 1963	Peshawar	18 mi. E. of Peshawar, on G.T. Road	"	2♂, 1♀	V. C. McCarthy and Z. B. Mirza
C 792A	13 Nov 1963	Hyderabad	8 mi. W. of Tatta (on Karachi Rd.)	<u>Capra hircus</u>	1♂, 1♀	"

TABLE 3. Material examined and identified as Boophilus annulatus (Say, 1821).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 796A	13 Nov 1963	Hyderabad	6 mi. NE of Tatta (Hyderabad Rd.)	<u>Bos indicus</u>	4♀	V. C. McCarthy and Z. B. Mirza
C 806	19 Nov 1963	Multan	7 mi. NW of Panjnad (on Muzaffargarh Rd.)	"	1♂	"
C 809A	20 Nov 1963	"	7 mi. SW of Panjnad	"	1♂, 3♀	"
C 857A	22 May 1964	Lahore	Changa Manga, Lahore Dist.	"	1♂, 15♀	"
C1010	7 Sept 1963	"	10 mi. above main Ravi Bridge, Lahore	"	1♂, 12♀	Nazeer M. Khan
C1407B	17 Sept 1964	"	Changa Manga Forest Lahore Dist.	"	3♂, 17♀	"

TABLE 4. Material examined and identified as Boophilus microplus (Canestrini, 1888).  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 48B	31 Jan 1963	Khairpur	Goth Goh-ram Khan 73 mi. SE of Khairpur	<u>Canis familiaris</u>	1♀	V. C. McCarthy and Z. B. Mirza
C 103B	14 Mar 1963	Lahore	Gujranwala Area	<u>Bos indicus</u>	1♂, 4♀	"
C 235A	3 May 1963	Bahawalpur	21 mi. SE of Bahawalpur	"	2♀	"
C 257A	10 May 1963	Karachi	Sonmiani Beach Area, 32 mi. W. of Karachi	"	3♀	"
C 260B	11 May 1963	Karachi	24 mi. ENE of Karachi on Thano Bula Khan Rd.	<u>Capra hircus</u>	1♀	"
C 264A	12 May 1963	Hyderabad	Buhara, 62 mi. ESE of Karachi	<u>Bos indicus</u>	3♀	"



TABLE 4. Material examined and identified as Boophilus microplus (Canestrini, 1888).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 276A	16 May 1963	Multan	7 mi. W. of Muzaffargarh on D. G.Khan Rd.	<u>Ovis aries</u>	5♀	V. C. McCarthy and Z. B. Mirza
C 285A	24 May 1963	Peshawar	3 mi. W. of Peshawar on Warsak Rd.	<u>Bos indicus</u>	1♀	"
C 288	26 May 1963	"	Margazar (8 mi. SW of Saidu)	"	6♂	"
C 289A	26 May 1963	"	Swat river bank near Saidu Sharif	<u>Bubalus bubalis</u>	3♀	"
C 292A	26 May 1963	"	Sirseena, 10 mi. W. of Saidu Sharif, Swat State	<u>Capra hircus</u>	1♀	"
C 294	26 May 1963	"	"	<u>Bos indicus</u>	13♂, 25♀	"

TABLE 4. Material examined and identified as Boophilus microplus (Canestrini, 1888).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 311B	3 June 1963	Peshawar	8 mi. N. of Mansehra	<u>Bos indicus</u>	31♂, 38♀	V. C. McCarthy and Z. B. Mirza
C 321A	6 June 1963	Rawalpindi	4 mi. SE of Rawalpindi	"	1♀	"
C 356A	20 July 1963	Quetta	Kingri, 83 mi. E. of Loralai	"	1♀	Z. B. Mirza
C 398B	4 Aug 1963	Karachi	Bela	"	6♀	"
C 402A	7 Aug 1963	"	Korangi Creek, 15 mi. E. of Karachi	"	1♀	"
C 428A	June 1964	Azad Kashmir	Neelum Valley (Ath-Maqum and Kail Area) 5,500-7,000 ft.	"	1♂, 3♀	Capt. Mahmood Ahmad, Dir. Anim. Husbandry Azad Kashmir
C 429	June 1964	"	"	"	1♂, 4♀	"
C 431	June 1964	"	"	"	1♀	"
C 432	June 1964	"	"	"	4♂, 11♀	"

TABLE 4. Material examined and identified as Boophilus microplus (Canestrini, 1888).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 433A	June 1964	Azad Kashmir	Neelum Valley (Ath-Maqum and Kail Area) 5,500-7,000 ft.	<u>Bos indicus</u> (?)	2♂, 10♀	Capt. Mahmood Ahmad, Dir. Anim. Husbandry Azad Kashmir
C 434A	June 1964	"	"	"	1♂	"
C 435	June 1964	"	"	"	2♂, 8♀	"
C 436	June 1964	"	"	"	14♂, 17♀	"
C 438	June 1964	"	"	"	3♂, 13♀	"
C 439A	June 1964	"	"	"	3♂, 13♀	"
C 452	6 Sept 1963	Peshawar	Changla Gali, Dist. Hazara, 9,000 ft.	"	7♂, 8♀	V. C. McCarthy and Z. B. Mirza
C 457	10 Sept 1963	"	Shogran, 7,700 ± ft., Kagan Valley	"	8♀	"

TABLE 4. Material examined and identified as Boophilus microplus (Canestrini, 1888).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 464	13 Sept 1963	Peshawar	Mahandri, 5,000 ft., Kagan Valley	<u>Bos indicus</u>	7♂, 4♀	V. C. McCarthy and Z. B. Mirza
C 465A	18 Sept 1963	"	Mansehra, Hazara Dist.	<u>Bubalus</u> <u>bubalis</u>	2♂, 1♀	"
C 466	18 Sept 1963	"	"	<u>Bos indicus</u>	6♂, 15♀	"
C 469	20 Sept 1963	"	Shangla, Swat State, 7,000 ft.	"	6♂, 2♀	"
C 471	20 Sept 1963	"	6 mi. E. of Shangla, Swat State, 7,000 ft.	"	7♂, 1♀	"
C 474	21 Sept 1963	"	8 mi. SW of Saidu Sharif, Swat State, 4,000 ft.	"	2♂, 1♀	"
C 483A	24 Sept 1963	Rawalpindi	13 mi. W. of Rawalpindi	"	1♀	"

TABLE 4. Material examined and identified as Boophilus microplus (Canestrini, 1888).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 488A	25 Sept 1963	Peshawar	5 mi. SW of Haripur	<u>Bos indicus</u>	5♀	V. C. McCarthy and Z. B. Mirza
C 491	26 Sept 1963	Rawalpindi	20 mi. NE of Rawalpindi (on Lehtrar Rd.)	<u>Bubalus bubalis</u>	2♂, 6♀	"
C 498A	16 Oct 1963	Multan	Gar, Taunsa Barrage	<u>Bos indicus</u>	1♀	"
C 524	20 April 1964	Peshawar	5 mi. from Saidu Sharif on Barain Rd., Swat State	"	38♂, 32♀	Traub Group
C 525	21 Apr 1964	Peshawar	5 mi. from Saidu Sharif on Barain Rd., Swat State	"	30♂, 42♀	"
C 526A	21 Apr 1964	"	3 mi. from Saidu Sharif on Marguzar Rd., Swat St.	"	23♂, 34♀	"

TABLE 4. Material examined and identified as Boophilus microplus (Canestrini, 1888).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 527	22 Apr 1964	Peshawar	3 mi. from Saidu Sharif on Marguzar Rd., Swat St.	<u>Bos indicus</u>	40♂, 46♀	Traub Group
C 528	23 Apr 1964	"	8 mi. from Saidu Sharif on Marguzar Rd., Swat St.	"	64♂, 95♀	"
C 529A	24 Apr 1964	"	Shangla, Swat State	"	88♂, 106♀	"
C 530	25 Apr 1964	"	"	"	4♂, 36♀	"
C 532	27 Apr 1964	"	5 mi. E. of Shangla, Swat State	"	15♂, 54♀	"
C 533A	3 May 1964	Rawalpindi	Komala (2,000 ft.), NE of Murree on Kashmir Rd.	"	5♀	"

TABLE 4. Material examined and identified as Boophilus microplus (Canestrini, 1888).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 537A	3 May 1964	Azad Kashmir	9 mi. NE of Kohala on Muzaffara-bad Rd.	<u>Bos indicus</u>	2♂, 6♀	Traub Group
C 539	29 Feb 1964	Rawalpindi	8 mi. NW of Rawalpindi (Peshawar Rd.)	"	1♀	"
C 571	20 Apr 1964	Peshawar	5 mi. N. of Saidu Sharif, Swat State	"	2♂, 13♀	"
C 655A	8 May 1964	Azad Kashmir	Muzaffara-bad	"	10♂	"
C 862A	25 June 1964	Peshawar	4 mi. S. of Saidu Sharif on Marghuzar Rd., Swat St.	"	20♂, 60♀	Z. B. Mirza and Nazeer M. Khan
C 863A	27 June 1964	Rawalpindi	Panjar, Rawalpindi Dist., (2,753 ft.) on Azad Pattan Rd.	<u>Bubalus bubalis</u>	1♀	"

TABLE 4. Material examined and identified as Boophilus microplus (Canestrini, 1888).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 869A	30 June 1964	Azad Kashmir	10 mi. S. of Muzaffarabad (on Srinagar Rd.)	<u>Bos indicus</u>	4♀	Z. B. Mirza and Nazeer M. Khan
C 870	30 June 1964	"	1,000 ft. above Chinari (4,000 ft.)	"	4♀	"
C 872	1 July 1964	"	1,500 ft. above Chinari (4,500 ft.)	"	1♀	"
C 876A	13 July 1964	Lahore	Bagrat, Sialkot Dist.	"	1♀	Z. B. Mirza
C 888	22 Aug 1964	Peshawar	Mahandri Hills(10,000 ft.), Kagan Valley	<u>Ochotona royali</u>	1♂	"
C 891	18 Aug 1964	"	Saifal Maluke Area (10,000 ft.), Kagan Valley	<u>Bos indicus</u>	1♂, 6♀	"



TABLE 4. Material examined and identified as Boophilus microplus (Canestrini, 1888).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 892	14 Aug 1964	Peshawar	Shogran 8,000 ft., Kagan Valley	<u>Bos indicus</u>	10♂, 32♀	Z. B. Mirza
C 954D	5 May 1963	Sargodha	Mianwali, Sargodha Dist.	"	1♀	Dept. of Animal Husbandry (West Pakistan)
C 971A	27 May 1963	Rawalpindi	Chakwal, Jhelum Dist.	"	1♀	"
C 983B	20 Aug 1963	Lahore	11 mi. SE of Lahore on Harike Rd.	<u>Bubalus</u> <u>bubalis</u>	1♀	Nazeer M. Khan
C 985C	20 Aug 1963	"	Paddri, 8 mi. SE of Lahore on Harike Rd.	"	1♀	"
C 1074A	17 Oct 1963	"	Narang, 24 mi. NE of Lahore (on Shahdara- Narang R.R.L.	<u>Bos indicus</u>	1♀	"

TABLE 4. Material examined and identified as Boophilus microplus (Canestrini, 1888).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1075A	17 Oct 1963	Lahore	Narang, 24 mi. NE of Lahore (on Shahdara-Narang R. R. L.)	<u>Bubalus bubalis</u>	1♂, 2♀	Nazeer M. Khan
C 1079A	18 Oct 1963	"	Bheni, 38 mi. NE of Lahore (Shahdara-Narang Rd.)	<u>Bos indicus</u>	3♀	"
C 1109A	13 Nov 1963	"	31 mi. WNW of Sheikhupura, 13 mi. from Pindi Bhattain (on Sheikhupura Rd.)	"	1♀	"
C 1111A	13 Nov 1963	"	24 mi. WNW of Sheikhupura, 20 mi. from Pindi Bhattain (on Sheikhupura Rd.)	"	1♂, 6♀	"

TABLE 4. Material examined and identified as Boophilus microplus (Canestrini, 1888).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1112A	14 Nov 1963	Sargodha	Tandianwala, Lyallpur Dist., 30 mi. S. of Lyallpur	<u>Bubalus bubalis</u>	1♂, 3♀	Nazeer M. Khan
C 1113A	14 Nov 1963	"	"	<u>Bos indicus</u>	2♂, 10♀	"
C 1115A	14 Nov 1963	"	27 mi. E. of Lyallpur (Sheikhupura Rd.)	<u>Bubalus bubalis</u>	1♀	"
C 1116A	16 Nov 1963	"	Jaranwala, 23 mi. SE of Lyallpur (Lahore Rd.)	"	4♀	"
C 1117A	16 Nov 1963	"	"	<u>Bos indicus</u>	1♂, 5♀	"
C 1118A	16 Nov 1963	"	8 mi. NW of Jaranwala (on Lyallpur Rd.)	<u>Bubalus bubalis</u>	1♂, 1♀	"

TABLE 4. Material examined and identified as Boophilus microplus (Canestrini, 1888).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1120A	16 Nov 1963	Sargodha	24 mi. NW of Jaranwala (on Lyallpur Rd.)	<u>Bos indicus</u>	1♀	Nazeer M. Khan
C 1129A	24 Nov 1963	Lahore	13 mi. E. of Lahore (Wagah Rd.)	<u>Lepus nigricollis</u>	1♀	"
C 1144A	6 Dec 1963	Lahore	10 mi. SE of Lahore (Harike Rd.)	<u>Bubalus bubalis</u>	1♂, 1♀	"
C 1145A	6 Dec 1963	"	"	<u>Bos indicus</u>	1♂, 1♀	"
C 1157	23 Dec 1963	"	21 mi. SE of Lahore (Harike Rd.)	"	1♂, 3♀	"
C 1158A	23 Dec 1963	"	25 mi. SE of Lahore (Harike Rd.)	"	1♀	"
C 1160A	23 Dec 1963	"	19 mi. E. of Lahore (near Wagah Border)	<u>Bubalus bubalis</u>	1♂, 2♀	"

TABLE 4. Material examined and identified as Boophilus microplus (Canestrini, 1888).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1164A	24 Dec 1963	Lahore	Mandian-wala, 15 mi. SE of Lahore (Harike Rd.)	<u>Bos indicus</u>	4♀	Nazeer M. Khan
C 1165A	24 Dec 1963	"	"	<u>Bubalus bubalis</u>	1♂, 1♀	"
C 1178A	30 Dec 1963	"	11 mi. S. of Lahore (Ferozepur Rd.)	"	1♀	"
C 1241	12 Mar 1964	Rawalpindi	Kahuta, 20 mi E. of Rawalpindi	<u>Lepus</u> sp.	1♀	"
C 1261	18 Mar 1964	Peshawar	Mansehra, 50 mi. N. of Rawalpindi	<u>Bos indicus</u>	5♀	"
C 1262D	18 Mar 1964	"	"	<u>Bubalus bubalis</u>	1♀	"

TABLE 4. Material examined and identified as Boophilus microplus (Canestrini, 1888).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1263	18 Mar 1964	Peshawar	5 mi. W. of Mansehra	<u>Bos indicus</u>	4♀	Nazeer M. Khan
C 1265	19 Mar 1964	"	3 mi. NW of Mansehra (on Oghi Rd.)	"	2♀	"
C 1266A	19 Mar 1964	"	"	<u>Ovis aries</u>	1♀	"
C 1267	19 Mar 1964	"	8 mi. NW of Mansehra (on Oghi Rd.)	<u>Bos indicus</u>	4♀	"
C 1268A	19 Mar 1964	"	"	<u>Bubalus bubalis</u>	2♀	"
C 1272B	24 Mar 1964	"	Mardan City	<u>Ovis aries</u>	14♂, 16♀	"
C 1273A	24 Mar 1964	"	"	<u>Bos indicus</u>	12♂, 10♀	"
C 1277B	25 Mar 1964	"	Shah Mansur, 11 mi. from Swabi, Mardan Dist.	<u>Ovis aries</u>	2♂, 5♀	"

TABLE 4. Material examined and identified as Boophilus microplus (Canestrini, 1888).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1278B	25 Mar 1964	Peshawar	Shah Mansur, 11 mi. from Swabi, Mardan Dist.	<u>Bos indicus</u>	14♂, 15♀	Nazeer M. Khan
C 1282A	26 Mar 1964	"	15 mi. NW of Mardan (Swat Rd.)	<u>Ovis aries</u>	13♂, 15♀	"
C 1285	28 Mar 1964	"	24 mi. NW of Mardan (on Malakand [Swat Rd.])	<u>Bos indicus</u>	10♂, 16♀	"
C 1286B	28 March 1964	"	"	<u>Ovis aries</u>	4♂, 6♀	"
C 1287B	28 March 1964	"	Malakand Town	<u>Bos indicus</u>	2♂, 7♀	"
C 1288	28 March 1964	"	"	<u>Ovis aries</u>	14♂, 6♀	"
C 1290A	30 March 1964	"	Mardan City	"	3♂, 7♀	"
C 1291A	30 March 1964	"	13 mi. S. of Mardan	"	3♂, 6♀	"

TABLE 4. Material examined and identified as Boophilus microplus (Canestrini, 1888).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1306	29 Apr 1964	Lahore	Balloki H. W., Lahore Dist.	<u>Bos indicus</u>	2♀	Nazeer M. Khan
C 1338D	28 May 1964	"	Malakpur, 11 mi. SE of Lahore (Harike Rd.)	"	1♀	"
C 1345A	11 June 1964	"	Jallo, 13 mi. E. of Lahore (Wagah Rd.)	"	2♂	"
C 1347A	11 June 1964	"	Pathe, 17 mi. E. of Lahore (Amritsar R. R. L.)	"	2♀	"
C 1362C	19 July 1964	"	Balloki H. W.	<u>Bubalus bubalis</u>	2♀	"



TABLE 5. Material examined and identified as Dermacentor raskemensis Pomerantsev, 1946.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 148A	30 Mar 1963	Quetta	Urrak, 14 mi. E. of Quetta, 6,994 ft.	<u>Ovis aries</u>	3♂, 3♀	V. C. McCarthy and Z. B. Mirza
C 149A	30 Mar 1963	"	"	<u>Capra hircus</u>	12♂, 8♀	"
C 151A	30 Mar 1963	"	Hanna, 8 mi. E. of Quetta, 6,322 ft.	<u>Ovis aries</u>	17♂, 2♀	"
C 196	9 Apr 1963	"	6 mi. E. of Ziarat on Loralai Rd.	<u>Capra hircus</u>	14♂, 6♀	"
C 197A	9 Apr 1963	"	"	<u>Ovis aries</u>	1♀	"
C 500	20 Oct 1963	"	Ziarat (Sibi Dist.) , 8,040 ft.	Off ground	10♂, 13♀	"
C 502A	21 Oct 1963	"	3 mi. from Ziarat (Sibi) on Quetta Rd. 6,000 <sup>±</sup> ft.	<u>Capra hircus</u>	1♂	"

TABLE 5. Material examined and identified as Dermacentor raskemensis Pomerantsev, 1946.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 503	21 Oct 1963	Quetta	3 mi. from Ziarat on Quetta Rd. 6,000 $\pm$ ft.	<u>Ovis aries</u>	1 $\sigma$	V. C. McCarthy and Z. B. Mirza
C 506A	22 Oct 1963	"	Ziarat (Sibi) 8,000 ft.	Off ground	8 $\sigma$ , 24 $\phi$	"

TABLE 6. Material examined and identified as Haemaphysalis bispinosa Neumann, 1897.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 186	20 Apr 1963	Khairpur	Khairpur Dist.	<u>Axis</u> <u>porcinus</u> <u>porcinus</u>	1♂, 2♀	Patton
C 187A	20 Apr 1963	"	"	<u>Sus scrofa</u> <u>cristatus</u>	1♂	"
C 251A	8 May 1963	"	Tajjal, Khairpur Dist.	<u>Lepus</u> <u>nigricollis</u>	1♀	V. C. McCarthy and Z. B. Mirza
C 433B	June 1964	Azad Kashmir	Neelum Valley (Ath-Maquum and Kali Area) 5, 500-7, 000 ft.	"cattle"	1♀	Capt. Mahmood Ahmad, Dir. Animal Husbandry Azad Kashmir
C 439B	June 1964	"	"	"	1♀	"
C 537B	3 May 1964	"	9 mi. NE of Kohala on Muzaffarabad Rd., Azad Kashmir	<u>Bos indicus</u>	1♂, 7♀	Traub Group
C 656B	7 May 1964	"	Muzaffarabad	<u>Capra hircus</u>	1♂, 4♀	"

TABLE 7. Material examined and identified as Haemaphysalis cornupunctata Hoogstraal and Varma, 1962.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
HH 6407	19 Apr 1964	Peshawar	Near Saidu Sharif, Swat State, 10,000 ft.	"wild goat"	2♂	Traub Group
B 67620	3 Apr 1964	"	Saidu Sharif, Swat State, 4,500 ft.	<u>Ovis aries</u> (domestic)	1♂, 1♀	"

TABLE 8. Material examined and identified as Haemaphysalis erinacei turanica Pospelova-Shtrom, 1939. Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 217A	7 Apr 1963	Kalat	77 mi SSW of Kalat on Panjgur Rd.	<u>Hemiechinus megalotis</u>	1♂	V. C. McCarthy and Z. B. Mirza
C 628	19 Jun 1964	Quetta	Quetta	"hedgehog"	1♀	Traub Group
C 667	23 Jun 1964	"	"	"	6♂	"

TABLE 9. Material examined and identified as Haemaphysalis howletti Warburton, 1913.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
N 1979 (Nuttall Collection)	1912	Rawalpindi	Rawalpindi	"hill pony"	1♂, 1♀	F. N. Howlett

TABLE 10. Material examined and identified as Haemaphysalis intermedia Warburton and Nuttall, 1909.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 801	13 Nov 1963	Hyderabad	Tatta, (back of Rest House	<u>Francolinus</u> <u>pondicerianus</u>	1♀	V. C. McCarthy and Z. B. Mirza

TABLE 11. Material examined and identified as Haemaphysalis kashmirensis Hoogstraal and Varma, 1962.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 473	17 Sept 1963	Peshawar	Kagan, Kagan Valley 5,000 ft.	<u>Capra hircus</u>	2♂, 1♀	Shah Jahan Shah
C 531B	27 Apr 1964	"	5 mi. E. of Shangla, Swat State	"	1♂, 1♀	Traub Group
C 889	22 Aug 1964	"	Mahandri Hills, Kagan Valley, 8,000 ft.	Off ground	1♀	Z. B. Mirza
C 1422	17 Sept 1963	"	Kagan	<u>Ovis aries</u>	2♂, 4♀	- - - - -



TABLE 12. Material examined and identified as Haemaphysalis kutchensis Hoogstraal and Trapido, 1963.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 113C	20 Mar 1963	D. I. Khan	8 mi. from Kalabagh Area on Jaba Rd.	<u>Lepus nigricollis</u>	15♂, 2♀	V. C. McCarthy and Z. B. Mirza
C 413A	10 Aug 1963	Khairpur	Nawabshah	<u>Lepus nigricollis</u> <u>dayanus</u>	6♂, 3♀	Z. B. Mirza
C 787A	12 Nov 1963	Hyderabad	Tatta	<u>Lepus nigricollis</u>	2♂	V. C. McCarthy and Z. B. Mirza
C 821A	3 Mar 1964	Lahore	6 mi. from Balloki H.W. on Lower Bari Doab Canal	<u>Centropus sinensis</u>	1♂	"
C 1013A	7 Sept 1963	"	8 mi. above Main Ravi Bridge, Lahore	<u>Lepus nigricollis</u>	1♀	Nazeer M. Khan
C 1154A	10 Dec 1963	"	13 mi. E. of Lahore (Wagah Rd.)	"	1♂	"
C 1321	25 May 1964	"	11 mi. NE of Lahore	"	5♂	"
C 1341	2 Jun 1964	"	12 mi. E. of Lahore (Wagah Rd.)	"	1♂	"

TABLE 13. Material examined and identified as Haemaphysalis leachii (Audouin, 1827).  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 18B	26 Sept 1962	Lahore	Balloki	<u>Canis aureus</u>	3♂, 1♀	Z. B. Mirza
C 70	10 Feb 1963	Hyderabad	Charatha, 8 mi. SE of Gharo (Sind)	<u>Herpestes auropunctatus</u>	19♂, 2♀	V. C. McCarthy and Z. B. Mirza
C 71	10 Feb 1963	"	Soomra Lake, Thatta Dist., Sind	"	16♂, 1♀	"
C 176	20 May 1963	Lahore	Lahore	"	10♂, 2♀	A. B. Mirza
C 859	22 May 1964	"	Changa Manga	<u>Herpestes edwardsi</u>	49♂, 13♀	Z. B. Mirza
C 894	3 Sept 1964	Lahore	"	<u>Herpestes auropunctatus</u>	4♂, 1♀	"
C 982	19 Aug 1963	"	Harbanspura (Forest Area, 8 mi. E. of Lahore)	<u>Vulpes bengalensis</u>	4♂, 6♀	Nazeer M. Khan
C 988A	21 Aug 1963	"	Forest, 15 mi. SE of Lahore (on Harike Rd.)	"	2♂	"
C 990A	21 Aug 1963	"	Forest, 15 mi. SE of Lahore (on Harike Rd.)	"	1♂, 3♀	"

TABLE 13. Material examined and identified as Haemaphysalis leachii (Audouin, 1827).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 992C	22 Aug 1963	Lahore	Harbanspura Forest 8 mi. E. of Lahore	<u>Vulpes bengalensis</u>	6♂, 7♀	Nazeer M. Khan
C 994A	25 Aug 1963	"	"	<u>Canis aureus</u>	4♂, 2♀	"
C 995A	25 Aug 1963	"	"	"	6♂, 5♀	"
C 1134	4 Dec 1963	"	10 mi. SE of Lahore (Harike Rd.)	<u>Herpestes auropunctatus</u>	2♀	"
C 1220	8 Feb 1964	Hyderabad	Goth Soofi, 7 mi. W. of Umarnkot, Thar Parkar Dist.	<u>Herpestes</u> sp.	10♂, 3♀	"
C 1343	7 Jun 1964	Lahore	Barki, 17 mi. SE of Lahore (Harike Rd.)	<u>Herpestes auropunctatus</u>	9♂, 1♀	"
C 1351	15 Jul 1964	"	Jaman, 22 mi. SSE of Lahore	"	2♂, 2♀	"
C 1406A	17 Sept 1964	"	Changa Manga Forest, Lahore Dist.	"	1♂	"
C 1414	15 Oct 1964	"	"	<u>Herpestes edwardsi</u>	1♂	"
C 1423	1963		West Pakistan	- - - - -	7♂, 4♀	R. D. Taber

TABLE 14. Material examined and identified as Haemaphysalis montgomeryi Nuttall, 1912.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 291A	26 May 1963	Peshawar	15 mi. W. of Saidu Sharif, Swat State	<u>Capra hircus</u>	16♂, 3♀	V. C. McCarthy and Z. B. Mirza
C 295	27 May 1963	"	Bahrain, Swat State	"	11♂, 11♀	"
C 297A	28 May 1963	"	Bahrain (2 mi. S.), Swat State	"	2♂, 1♀	"
C 299A	29 May 1963	"	Kalam, Swat State	"	7♂, 5♀	"
C 301	30 May 1963	"	10 mi. N. W. of Kalam, Swat State	"	18♂, 10♀	"
C 302	30 May 1963	"	"	<u>Ovis aries</u>	3♂, 2♀	"
C 304	30 May 1963	"	8 mi. NE of Kalam, Swat State	<u>Capra hircus</u>	26♂, 7♀	"
C 309A	3 Jun 1963	"	8 mi. N. of Mansehra	"	7♂, 5♀	"
C 310A	3 Jun 1963	"	"	"	35♂, 5♀	"
C 312A	3 Jun 1963	"	"	<u>Bubalus bubalis</u>	1♂	"
C 313A	3 Jun 1963	"	9 mi. NE of Naran in the Kagan Valley	<u>Capra hircus</u>	4♂, 2♀	"

TABLE 14. Material examined and identified as Haemaphysalis montgomeryi Nuttall, 1912.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 314	3 Jun 1963	Peshawar	5 mi. NE of Balakot, Kagan Valley	<u>Ovis aries</u>	22♂, 6♀	V. C. McCarthy and Z. B. Mirza
C 315	3 Jun 1963	"	Balakot, Kagan Valley	<u>Capra hircus</u>	3♂, 2♀	"
C 318	5 Jun 1963	"	Dunga Gali, 10 mi. N. of Murree	<u>Canis familiaris</u>	1♀	"
C 319	5 Jun 1963	"	1,500 ft. below Kundla, 15 mi. N. of Murree	<u>Capra hircus</u>	6♂	"
C 427	June, 1964	Azad Kashmir	Neelum Valley (Ath-Maqum and Kali Area) 5,500-7,000 ft.	"cattle"	1♀	Capt. Mahmood Ahmad, Dir. Animal Husbandry
C 428B	June, 1964	"	"	"	1♂, 1♀	"
C 453	7 Sept 1963	Peshawar	Khanaspur, Hazara Dist., 7,000 ft.	<u>Capra hircus</u>	1♂, 1♀	V. C. McCarthy and Z. B. Mirza
C 458	10 Sept 1963	"	Shogran, Kagan Valley 7,700 ft.	"	18♂	"
C 459	10 Sept 1963	"	"	<u>Ovis aries</u>	10♂	"

TABLE 14. Material examined and identified as Haemaphysalis montgomeryi Nuttall, 1912.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 463	13 Sept 1963	Peshawar	Mahandri, Kagan Valley, 5,000 ft.	<u>Capra hircus</u>	3♂	V. C. McCarthy and Z. B. Mirza
C 467	20 Sept 1963	"	Shangla, Swat State, 7,000 ft.	<u>Ovis aries</u>	4♂	"
C 468	20 Sept 1963	"	"	<u>Capra hircus</u>	2♂	"
C 470	20 Sept 1963	"	10 mi. E. of Shangla on Karora Rd. (Swat State), 7,000 ft.	"	2♂	"
C 493A	26 Sept 1963	Rawalpindi	18 mi. E. of Rawalpindi (on Azad Kashmir Rd.)	"	1♂	"
C 531A	27 Apr 1964	Peshawar	5 mi. E. of Shangla, Swat State	"	32♂, 17♀	Traub Group
C 535A	3 May 1964	Azad Kashmir	8 mi. NE of Kohala on Muzaffarabad Rd.	<u>Bos indicus</u>	2♂, 1♀	"
C 536A	3 May 1964	"	"	<u>Capra hircus</u>	10♂, 5♀	"
C 537C	3 May 1964	"	"	<u>Bos indicus</u>	4♂, 6♀	"
C 656A	7 May 1964	"	Muzaffarabad	<u>Capra hircus</u>	5♂, 4♀	"

TABLE 14. Material examined and identified as Haemaphysalis montgomeryi Nuttall, 1912.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 669B	23 Jan 1964	Peshawar	Saidu Sharif, Swat State	<u>Ovis aries</u>	1♀	Traub Group
C 781	7 May 1964	Azad Kashmir	E. Bank of Jhelum, S. of Muzaffarabad	<u>Capra hircus</u>	9♂, 1♀	"
C 782	1964	Peshawar	Saidu Sharif, Swat State	"wild goat"	1♀	"
C 865	28 Jun 1964	Azad Kashmir	Muzaffarabad	<u>Capra hircus</u>	5♂, 1♀	Z. B. Mirza and Nazeer M. Khan
C 868A	29 Jun 1964	"	10 mi. S. of Muzaffarabad (on Srinagar Rd.)	<u>Bubalus bubalis</u>	1♂, 1♀	"
C 869B	30 Jun 1964	"	10 mi. S. of Muzaffarabad (on Srinagar Rd.)	<u>Bos indicus</u>	2♀	"
C 873	1 Jul 1964	"	3 mi. E. of Chinari	<u>Capra hircus</u>	17♂, 3♀	"
C 882	13 Aug 1964	Peshawar	Shogran, 8,000 ft.	"	7♂, 1♀	"
C 883	14 Aug 1964	"	Shogran, Kagan Valley 9,500 ft.	<u>Nucifraga caryocatactes multipunctata</u>	1♀	"

TABLE 14. Material examined and identified as Haemaphysalis montgomeryi Nuttall, 1912.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 886	18 Aug 1964	Peshawar	Saifal Maluke Lake, Kagan Valley, 10,500 ft.	<u>Capra hircus</u>	11♂	Z. B. Mirza and Nazeer M. Khan
C 887	20 Aug 1964	"	Saifal Maluke Lake Area, Kagan Valley, 12,000 ft.	<u>Marmota caudata</u> <u>caudata</u>	3♂	Z. B. Mirza
C 1380A	12 Aug 1964	Rawalpindi	Barrian, 8,000 ft., 5 mi. NE of Murree	<u>Capra hircus</u>	2♂, 1♀	Nazeer M. Khan
C 1381	13 Aug 1964	Peshawar	Nathia Gali, Hazara Dist., 8,000 ft.	"	9♂, 3♀	"
C 1382	13 Aug 1964	"	"	<u>Bubalus bubalis</u>	2♀	"
C 1383	15 Aug 1964	Rawalpindi	Patriatta, 14 mi. E. of Murree, 7,000 ft.	<u>Capra hircus</u>	21♂, 8♀	"
C 1384	15 Aug 1964	"	Dhanda, 12 mi. E. of Murree, 6,000 ft.	"	5♂, 2♀	"
C 1385	15 Aug 1964	"	Gurralla Gali, 10 mi. E. of Murree, 3,500 ft.	"	13♂, 16♀	"
C 1386A	21 Aug 1964	Lahore	13 mi. SE of Lahore (Harike Rd.)	<u>Bos indicus</u>	1♀	"



TABLE 15. Material examined and identified as Haemaphysalis sulcata (Canestrini and Fanzago, 1877).  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 72A	10 Feb 1963	Hyderabad	Kirthar Range, 20 mi. N. of Thano Bulla Khan, 50 mi. W. of Hyderabad	<u>Capra hircus blythi</u>	2♂	Patton and Hunting Party
C 135A	26 Mar 1963	Quetta	Ft. Sandeman, 4,500 ft.	Domestic animals (sheep, goats, cattle, camels, buffalo)	1♀	Dept. Animal Husbandry (West Pakistan)
C 137A	27 Mar 1963	"	Suleman Zai (30 mi. SW of Ft. Sandeman on Loralai Rd.) 4,500 ft.	<u>Ovis aries</u>		V. C. McCarthy and Z. B. Mirza
C 147	30 Mar 1963	"	Urrak, 14 mi. E. of Quetta, 6,994 ft.	<u>Capra hircus</u>	1♂	"
C 148B	30 Mar 1963	"	"	<u>Ovis aries</u>	1♂, 3♀	"
C 149B	30 Mar 1963	"	"	<u>Capra hircus</u>	1♀	"
C 155A	31 Mar 1963	"	5 mi. S. of Chaman on Baghrat Top Road	<u>Ovis aries</u>	1♀	"
C 175A	1 Jan 1963	Rawalpindi	65 mi. SE of Rawalpindi	<u>Ovis orientalis punjabiensis</u>	5♂, 3♀	A. B. Mirza

TABLE 15. Material examined and identified as Haemaphysalis sulcata (Canestrini and Fanzago, 1877).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 462	13 Sept 1963	Peshawar	Mahandri, Kagan Valley, 5,000 ft.	<u>Agama tuberculata</u>	1♀	V. C. McCarthy and Z. B. Mirza
C 502B	21 Oct 1963	Quetta	3 mi. from Ziarat (Sibi) on Quetta Rd. 6,000 ft.	<u>Capra hircus</u>	1♂	"
C 504	21 Oct 1963	"	8 mi. from Ziarat on Quetta Rd. 6,000 ft.	"	4♂, 1♀	"
C 506B	22 Oct 1963	"	Ziarat (Sibi) 8,000 ft.	Off ground	13♂, 18♀	"
C 554C	22 Mar 1964	Rawalpindi	Islamabad	<u>Ovis aries</u>	1♂, 1♀	Traub Group
C 558	22 Mar 1964	D. I. Khan	Parachinar, Kohat Dist.	<u>Bos indicus</u>	1♀	"
C 657A	18 Apr 1964	Peshawar	Saidu-Saidu Sharif, Swat State	"	1♂	"
C 810	1 Dec 1963	Rawalpindi	65 mi. SE of Rawalpindi, Jhelum Dist.	<u>Ovis orientalis punjabensis</u>	4♂, 3♀	Rooney
C 1255B	15 Mar 1964	Rawalpindi	Mulwar, 22 mi. N. of Rawalpindi	<u>Ovis aries</u>	1♂	Nazeer M. Khan

TABLE 15. Material examined and identified as Haemaphysalis sulcata (Canestrini and Fanzago, 1877).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1266B	19 Mar 1964	Peshawar	3 mi. NW of Mansehra (Oghi Rd.)	<u>Ovis aries</u>	1♂	Nazeer M. Khan

TABLE 16. Material examined and identified as Hyalomma aegyptium (Linnaeus, 1785).  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 216	9 Apr 1963	Quetta	46 mi. E. of Quetta on Ziarat Rd.	<u>Testudo</u> <u>elongata</u>	4♂, 8♀	V. C. McCarthy and Z. B. Mirza

TABLE 17. Material examined and identified as Hyalomma brevipunctata Sharif, 1928.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
HH 2732	Jan, 1944	Karachi	Karachi	"human"	1♂	- - - - -

TABLE 18. Material examined and identified as Hyalomma hussaini Sharif, 1928.  
Distribution: West Pakistan.

Collection		Administrative		Host	Specimens	Collector
No.	Date	Division	Locality			
C 264C	12 May 1963	Hyderabad	Buhara, 62 mi. ESE of Karachi	<u>Bos indicus</u>	4♂, 4♀	V. C. McCarthy and Z. B. Mirza
C 796B	13 Nov 1963	"	6 mi. NE of Tatta (Hyderabad Rd.)	"	3♂	"
C 1219B	8 Feb 1964	"	Goth Soofi, 7 mi. W. of Umarkot, Thar Parkar Dist.	<u>Equus caballus</u>	1♂	Nazeer M. Khan

TABLE 19. Material examined and identified as Hyalomma kumari Sharif, 1928.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 67	4 Feb 1963	Hyderabad	Nagar Parkar	<u>Capra hircus</u>	2♂, 2♀	V. C. McCarthy and Z. B. Mirza
C 72B	10 Feb 1963	"	Kirthar Range, 20 mi. N. of Thano Bulla Khan, 50 mi. W. of Hyderabad	<u>Capra hircus blythi</u>	1♂	Patton and Hunting Party
C 813	7 Feb 1964	"	Nagar Parkar	<u>Capra hircus</u>	27♂, 21♀	V. C. McCarthy and Z. B. Mirza

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 2A	24 Aug 1962	Lahore	Kahna Kacha 18 mi. S. of Lahore	<u>Bos indicus</u>	5♂	V. C. McCarthy
C 3A	31 Aug 1962	"	Shahzada 19 mi. S. of Lahore	<u>Bubalus</u> <u>bubalis</u>	7♂	"
C 4A	6 Sept 1962	"	"	"	6♂, 4♀	"
C 5A	6 Sept 1962	"	"	"	4♂, 3♀	"
C 8A	17 Sept 1962	"	"	<u>Bos indicus</u>	28♂, 3♀	"
C 9	19 Sept 1962	"	Sheikhup- ura City	"	1♂, 1♀	"
C 12A	19 Sept 1962	"	"	<u>Bubalus</u> <u>bubalis</u>	10♂	"
C 13A	19 Sept 1962	"	Sheikhup- ura	<u>Equus</u> <u>caballus</u>	3♂	"
C 24	21 Nov 1962	"	Kot Abdul Malik, Dist. Sheikhupura	<u>Bubalus</u> <u>bubalis</u>	1♂	Z. B. Mirza



TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 25A	21 Nov 1962	Lahore	Kot Abdul Malik, Dist. Sheikhpura	<u>Camelus dromedarius</u>	19♂, 2♀	Z. B. Mirza
C 27	27 Jan 1963	Bahawalpur	Bahawalpur Zoo	<u>Bos indicus</u>	3♂	V. C. McCarthy and Z. B. Mirza
C 28A	25 Jan 1963	Multan	Haveli, 12 mi. NW of Sulemanki Headworks	<u>Camelus dromedarius</u>	11 ♂	"
C 29	27 Jan 1963	Bahawalpur	Bahawalpur Zoo	<u>Bos indicus</u>	10♂, 7♀	"
C 30	27 Jan 1963	"	Bahawalpur	<u>Bubalus bubalis</u>	9♂, 7♀	"
C 32A	27 Jan 1963	"	Janu Wali, 20 mi. SSE of Yazman	<u>Capra hircus</u>	2♂	"
C 35	28 Jan 1963	"	Dera Nawab Sahib	<u>Bos indicus</u>	18♂, 4♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 38A	28 Jan 1963	Bahawalpur	Ft. Dera-war	<u>Bos indicus</u>	1♂	V. C. McCarthy and Z. B. Mirza
C 39A	29 Jan 1963	"	Ahmadpur East	<u>Capra hircus</u>	3♂, 3♀	"
C 42	29 Jan 1963	"	"	<u>Equus caballus</u>	26♂, 1♀	"
C 43A	29 Jan 1963	"	"	<u>Ovis aries</u>	14♂, 6♀	"
C 45	29 Jan 1963	"	Dera Nawab Sahib	<u>Equus caballus</u>	11♂, 1♀	"
C 46A	29 Jan 1963	"	"	<u>Bos indicus</u>	1♂	"
C 65A	4 Feb 1963	Hyderabad	Nagar Parkar	Off ground	1♂, 1♀	"
C 66A	4 Feb 1963	"	"	<u>Bos indicus</u>	1♂	"
C 73	16 Feb 1963	"	Manchar Lake (30 mi. from Dadu) Sind	<u>Ovis aries</u>	10♂, 5♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 78A	17 Feb 1963	Khairpur	6 mi. NW of Jacobabad on Quetta Rd.	<u>Capra hircus</u>	3♂, 1♀	V. C. McCarthy and Z. B. Mirza
C 79A	17 Feb 1963	"	8 mi. NW of Jacobabad on Quetta Rd.	<u>Bubalus bubalis</u>	3♂, 2♀	"
C 86A	6 Mar 1963	Lahore	Attari Saroba 11 mi. S. of Lahore	"	10♂, 6♀	"
C 87A	6 Mar 1963	"	"	<u>Bos indicus</u>	4♂, 4♀	"
C 90A	6 Mar 1963	"	"	<u>Camelus dromedarius</u>	4♂	"
C 94A	9 Mar 1963	"	Nabi Pura, 15 mi. WNW of Lahore on Sheikhupura Rd.	<u>Bubalus bubalis</u>	2♂, 2♀	"
C 96A	13 Mar 1963	"	Lalu Khichi (Balloki H.W.) 40 mi. from Lahore	"	2♂	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 97	13 Mar 1963	Lahore	Lalu Khichi (Balloki) 40 mi. from Lahore	<u>Bos indicus</u>	3♂, 1♀	V. C. McCarthy and Z. B. Mirza
C 99A	14 Mar 1963	"	Bharoke, 25 mi. from Lahore on Gujranwala Rd.	"	3♂, 2♀	"
C 100	14 Mar 1963	"	"	<u>Bubalus bubalis</u>	28♂, 2♀	"
C 101A	14 Mar 1963	"	Manhase, 25 mi. N. of Lahore on Gujranwala Rd.	"	10♂, 3♀	"
C 103A	14 Mar 1963	"	Gujranwala Area	<u>Bos indicus</u>	6♂, 2♀	"
C 104	14 Mar 1963	"	"	<u>Bubalus bubalis</u>	3♂	"
C 105A	14 Mar 1963	"	"	<u>Ovis aries</u>	1♂	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 106	20 Mar 1963	D. I. Khan	Kalabagh	<u>Bos indicus</u>	6♂, 2♀	V. C. McCarthy and Z. B. Mirza
C 107	20 Mar 1963	"	Kalabagh	<u>Bubalus bubalis</u>	15♂, 1♀	"
C 108	20 Mar 1963	"	Kalabagh	<u>Equus caballus</u>	1♂, 2♀	"
C 109A	20 Mar 1963	"	Kalabagh	<u>Ovis aries</u>	11♂, 5♀	"
C 111A	20 Mar 1963	"	Kalabagh	<u>Camelus dromedarius</u>	10♂, 7♀	"
C 114A	21 Mar 1963	"	Khuda Zai, 9 mi. SW of Kalabagh on Banu Rd.	"	5♂, 4♀	"
C 115A	21 Mar 1963	"	"	<u>Bos indicus</u>	2♀	"
C 117A	23 Mar 1963	"	D. I. Khan City	<u>Ovis aries</u>	1♂, 2♀	"
C 118D	23 Mar 1963	"	D. I. Khan City	<u>Capra hircus</u>	22♂, 8♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 119A	23 Mar 1963	D. I. Khan	D. I. Khan City	<u>Bubalus bubalis</u>	5♂, 2♀	V. C. McCarthy and Z. B. Mirza
C 120B	23 Mar 1963	"	Pusha, 8 mi. from D. I. Khan on Banu Rd.	<u>Camelus dromedarius</u>	5♂, 4♀	"
C 122A	24 Mar 1963	"	3 mi. W. of D. I. Khan on Paharpur Canal	<u>Bos indicus</u>	1♂	"
C 123	24 Mar 1963	"	"	<u>Bubalus bubalis</u>	4♂, 4♀	"
C 124 A	24 Mar 1963	"	4 mi. W. of D. I. Khan on Paharpur Canal	<u>Capra hircus</u>	1♂, 1♀	"
C 125A	24 Mar 1963	"	5 mi. W. of D. I. Khan on Paharpur Canal	<u>Ovis aries</u>	9♂, 4♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 126B	24 Mar 1963	D. I. Khan	5 mi W. of D. I. Khan on Paharpur Canal	<u>Capra hircus</u>	10♂, 4♀	V. C. McCarthy and Z. B. Mirza
C 127	24 Mar 1963	"	Sheikhs Khu, 14 mi. S. of D. I. Khan on D. G. Khan Rd.	<u>Ovis aries</u>	8♂, 16♀	"
C 132F	26 Mar 1963	Quetta	Ft. Sandeman 4, 500 <sup>±</sup> ft.	Misc. Dom. animals (sheep, goats, cattle, camels, buffalo)	120 ♂, ♀	Dept. of Animal Husbandry, (West Pakistan)
C 135B	26 Mar 1963	"	Ft. Sandeman 4, 500 <sup>±</sup> ft.	"	27♂, 20♀	"
C 137C	27 Mar 1963	"	Suleman Zai 4, 500 ft. (30 mi. SW of Ft. Sandeman on Loralai Rd.	<u>Ovis aries</u>	1♂	V. C. McCarthy and Z. B. Mirza
C 142	29 Mar 1963	"	Quetta City, 5, 000 ft.	<u>Bubalus bubalis</u>	11♂, 4♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 143A	29 Mar 1963	Quetta	Quetta City, 5,000 ft.	<u>Camelus dromedarius</u>	4♂, 2♀	V. C. McCarthy and Z. B. Mirza
C 148C	30 Mar 1963	"	Urrak, 14 mi. E. of Quetta, 6,994 ft.	<u>Ovis aries</u>	1♂	"
C 154A	31 Mar 1963	"	Chaman, 60 mi. NNW of Quetta	<u>Camelus dromedarius</u>	2♀	"
C 162A	5 Apr 1963	Kalat	Irrai, 4 mi. S. of Panjgur on Turbat Rd.	<u>Ovis aries</u>	11♂, 4♀	"
C 163A	5 Apr 1963	"	Borristan, 6 mi. S. of Panjgur on Turbat Rd.	<u>Bos indicus</u>	16♂, 9♀	"
C 165	5 Apr 1963	"	"	<u>Ovis aries</u>	10♂, 5♀	"
C 167A	5 Apr 1963	"	Vashbodth, 3 mi. NE of Panjgur on Kalat Rd.	<u>Capra hircus</u>	24♂, 11♀	"



TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 168	5 Apr 1963	Kalat	Vashbodth, 3 mi. NE of Panjgur on Kalat Rd.	<u>Ovis aries</u>	73♂, 36♀	V. C. McCarthy and Z. B. Mirza
C 169A	5 Apr 1963	"	"	<u>Bos indicus</u>	2♂, 1♀	"
C 190	8 Apr 1963	"	Malki, 5 mi. N. of Kalat on Quetta Rd.	"	1♀	"
C 191A	8 Apr 1963	"	Ziarat, 12 mi. N. of Kalat on Quetta Rd.	<u>Camelus dromedarius</u>	3♂, 1♀	"
C 193B	8 Apr 1963	"	"	<u>Bos indicus</u>	4♂	"
C 199A	10 Apr 1963	Quetta	Zangi wal, 3 mi. E. of Loralai	<u>Ovis aries</u>	1♂	"
C 201	10 Apr 1963	"	"	<u>Bubalus bubalis</u>	12♂, 4♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 205A	11 Apr 1963	Quetta	4 mi. from Loralai on Kila Saif Ullah Rd.	<u>Ovis aries</u>	4♂, 1♀	V. C. McCarthy and Z. B. Mirza
C 206A	11 Apr 1963	"	"	<u>Capra hircus</u>	4♂, 1♀	"
C 209	13 Apr 1963	Multan	Taunsa Barrage	<u>Bos indicus</u>	4♂, 2♀	"
C 210A	13 Apr 1963	"	"	<u>Ovis aries</u>	1♀	"
C 214	13 Apr 1963	"	14 mi. E. of Taunsa Barrage on Rangpur Rd.	<u>Capra hircus</u>	3♂, 6♀	"
C 215A	13 Apr 1963	"	"	<u>Camelus dromedarius</u>	5♂, 2♀	"
C 218	23 Apr 1963	Lahore	Rajkot, 3 mi. from Gujran-wala on Gondlawala Rd.	<u>Bubalus bubalis</u>	9♂, 7♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 219	23 Apr 1963	Lahore	Rajkot, 3 mi. from Gujranwala on Gondlawala Rd.	<u>Bos indicus</u>	48♂, 30♀	V. C. McCarthy and Z. B. Mirza
C 220A	23 Apr 1963	"	"	<u>Capra hircus</u>	1♂, 1♀	"
C 221A	23 Apr 1963	"	"	<u>Ovis aries</u>	8♂, 2♀	"
C 222A	23 Apr 1963	"	Balloki H.W. 40 mi. from Lahore	<u>Bubalus bubalis</u>	14♂, 2♀	Z. B. Mirza
C 223A	23 Apr 1963	"	"	<u>Bos indicus</u>	3♂, 1♀	"
C 224B	23 Apr 1963	"	"	<u>Camelus dromedarius</u>	1♂	"
C 226	24 Apr 1963	"	Rajkot, 3 mi. from Gujranwala on Gondlawala Rd.	<u>Bubalus bubalis</u>	1♂	"
C 230A	24 Apr 1963	"	Gondlawala, 4 mi. from Gujranwala	"	3♂, 1♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 231A	2 May 1963	Bahawalpur	Lal Sohara- 22 mi. E. of Bahawalpur	<u>Ovis aries</u>	4♂, 1♀	V. C. McCarthy and Z. B. Mirza
C 232A	2 May 1963	"	9 mi. NE of Bahawalpur on Bahawal Nagar Rd.	<u>Capra hircus</u>	1♂	"
C 236A	3 May 1963	"	21 mi. SE of Bahawalpur	<u>Bubalus</u> <u>bubalis</u>	2♂	"
C 238A	3 May 1963	"	"	<u>Capra hircus</u>	2♂, 1♀	"
C 242A	5 May 1963	"	4 mi. S. of Dera Nowab Sahib	"	6♂, 2♀	"
C 243A	5 May 1963	"	"	<u>Ovis aries</u>	4♂, 4♀	"
C 245A	5 May 1963	"	10 mi. S. of Dera Nowab Sahib	<u>Camelus</u> <u>dromedarius</u>	1♂	"
C 259B	10 May 1963	Karachi	Hub, 11 mi. W. of Karachi	<u>Bos indicus</u>	3♂, 1♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 260D	11 May 1963	Karachi	24 mi. ENE of Karachi on Thano Bula Khan Rd.	<u>Capra hircus</u>	1♂, 1♀	V. C. McCarthy and Z. B. Mirza
C 262A	11 May 1963	"	"	<u>Ovis aries</u>	1♂, 3♀	"
C 263A	11 May 1963	"	14 mi. ENE of Karachi on Thano Bula Khan Rd.	<u>Bos indicus</u>	25♂, 10♀	"
C 264B	12 May 1963	Hyderabad	Buhara, 62 mi. ESE of Karachi	"	1♂	"
C 270A	14 May 1963	Khairpur	7 mi. from Gumbat Rest House on Roh-ri Canal (up-stream), 8 mi. SW of Khairpur	<u>Capra hircus</u>	2♂, 1♀	"
C 271A	14 May 1963	"	"	<u>Ovis aries</u>	1♂	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 273A	14 May 1963	Khairpur	16 mi. SW of Khairpur on Karachi Rd.	<u>Capra hircus</u>	1♂	V. C. McCarthy and Z. B. Mirza
C 275B	16 May 1963	Multan	7 mi. W. of Muzaffargarh on D. G. Khan Rd.	"	4♂, 3♀	"
C 276B	16 May 1963	"	"	<u>Ovis aries</u>	1♂, 1♀	"
C 279A	16 May 1963	"	8 mi. E. of Muzaffargarh (just short of Chenab Bridge)	"	2♂, 1♀	"
C 280	16 May 1963	"	"	<u>Bos indicus</u>	3♂	"
C 284A	23 May 1963	Peshawar	3 mi. from Charsadda on Tangi Rd., 20 mi. NE of Peshawar	<u>Ovis aries</u>	1♂	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 285B	24 May 1963	Peshawar	3 mi. W. of Peshawar on Warsak Rd.	<u>Bos indicus</u>	3♂, 1♀	V. C. McCarthy and Z. B. Mirza
C 287A	24 May 1963	"	3 mi. S. of Warsak, 12 mi. NW of Peshawar	<u>Ovis aries</u>	3♂, 1♀	"
C 305A	1 June 1963	"	Khyber Pass, Pak side	<u>Ovis aries</u>	4♂, 1♀	"
C 306	2 June 1963	"	3 mi. E. of Mansehra	"	3♂	"
C 308A	3 June 1963	"	5 mi. N. of Mansehra	"	2♀	"
C 328A	13 June 1963	"	Chilas	<u>Capra hircus</u>	1♂	Z. B. Mirza
C 340A	18 July 1963	Multan	Taunsa Barage, E. side	<u>Ovis aries</u>	4♂, 7♀	"
C 343A	18 July 1963	"	Taunsa Barage, W. bank	<u>Bos indicus</u>	15♂, 11♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 344	18 July 1963	Multan	Taunsa Bar- rage, W.bank	<u>Capra hircus</u>	2♂, 4♀	Z. B. Mirza
C 351A	19 July 1963	"	10 mi. E. of Taunsa Bar- rage	<u>Paraechinus</u> <u>hypomelas</u> <u>blanfordi</u>	1♂	"
C 355A	20 July 1963	Quetta	Kingri, 83 mi. E. of Loralai	<u>Capra hircus</u>	2♂	"
C 368A	24 July 1963	"	8 mi. W. of Ziarat on Quetta Rd., 6,000 ±ft.	<u>Camelus</u> <u>dromedarius</u>	13♂	"
C 373A	26 July 1963	"	Gulistan, 45 mi. NNW of Quetta	<u>Ovis aries</u>	4♂, 1♀	"
C 375A	26 July 1963	"	5 mi. S. of Gul- istan, 40 mi. NNW of Quetta	"	1♂, 1♀	"
C 381A	28 July 1963	"	Chaman	<u>Camelus</u> <u>dromedarius</u>	1♂	"



TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 382A	29 July 1963	Quetta	Nushki	<u>Bos indicus</u>	40♂, 2♀	Z. B. Mirza
C 389A	30 July 1963	"	"	"	20♂, 3♀	"
C 391A	1 Aug 1963	Kalat	Surab	"	2♂	"
C 392A	1 Aug 1963	"	"	<u>Camelus dromedarius</u>	6♂, 3♀	"
C 397A	4 Aug 1963	Karachi	Bela	"	2♂, 4♀	"
C 398C	4 Aug 1963	"	"	<u>Bos indicus</u>	4♂, 2♀	"
C 399A	4 Aug 1963	"	"	<u>Ovis aries</u>	6♂, 1♀	"
C 401	7 Aug 1963	"	Korangi Creek, 15 mi. E. of Karachi	<u>Camelus dromedarius</u>	31♂, 10♀	"
C 402B	7 Aug 1963	"	"	<u>Bos indicus</u>	13♂, 5♀	"
C 403A	7 Aug 1963	"	Hawks Bay, Karachi	<u>Canis aureus</u>	1♂	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 405A	8 Aug 1963	Karachi	Hawks Bay, Karachi	<u>Capra hircus</u>	28♂, 13♀	Z. B. Mirza
C 406A	8 Aug 1963	"	"	<u>Ovis aries</u>	28♂, 3♀	"
C 408A	10 Aug 1963	Khairpur	Nawabshah	<u>Capra hircus</u>	4♂	"
C 409A	10 Aug 1963	"	"	<u>Ovis aries</u>	7♂, 4♀	"
C 410A	10 Aug 1963	"	"	<u>Camelus dromedarius</u>	1♂	"
C 411	10 Aug 1963	"	"	<u>Bos indicus</u>	48♂, 45♀	"
C 414A	11 Aug 1963	"	Ubauro, 70 mi. NE of Sukkur	<u>Capra hircus</u>	1♀	"
C 415A	11 Aug 1963	"	"	<u>Ovis aries</u>	3♂, 2♀	"
C 417A	12 Aug 1963	"	"	<u>Bubalus bubalis</u>	8♂, 7♀	"
C 418A	12 Aug 1963	"	"	<u>Bos indicus</u>	10♂, 13♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 419A	13 Aug 1963	Bahawalpur	6 mi. S. of Bahawalpur (on Yazman Rd.)	<u>Camelus dromedarius</u>	21♂, 9♀	Z. B. Mirza
C 421A	13 Aug 1963	"	"	<u>Capra hircus</u>	2♂	"
C 423A	13 Aug 1963	"	"	<u>Bubalus bubalis</u>	1♀	"
C 424A	13 Aug 1963	"	Bahawalpur	<u>Equus caballus</u>	6♂, 4♀	"
C 426A	13 Aug 1963	"	Islam H. W. Bahawalpur	<u>Bubalus bubalis</u>	31♂, 7♀	"
C 441	13 Aug 1963	"	"	<u>Bos indicus</u>	7♂, 7♀	"
C 443A	14 Aug 1963	"	10 mi. E. of Islam H. W., Bahawalpur	"	31♂, 34♀	"
C 444A	14 Aug 1963	"	"	<u>Bubalus bubalis</u>	26♂, 24♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 445A	14 Aug 1963	Multan	20 mi. NW of Islam H. W.	<u>Bubalus bubalis</u>	96♂, 13♀	Z. B. Mirza
C 446	14 Aug 1963	"	"	<u>Bos indicus</u>	86♂, 36♀	"
C 447A	14 Aug 1963	"	"	<u>Capra hircus</u>	1♂	"
C 448A	14 Aug 1963	"	"	<u>Ovis aries</u>	2♂, 3♀	"
C 449A	14 Aug 1963	"	"	<u>Camelus dromedarius</u>	15♂, 16♀	"
C 475	22 Sept 1963	Peshawar	University Campus, Peshawar	<u>Ovis aries</u>	10♂, 12♀	V. C. McCarthy and Z. B. Mirza
C 476	22 Sept 1963	"	10 mi. W. of Peshawar	"	2♂	"
C 478	22 Sept 1963	"	"	<u>Bos indicus</u>	4♂, 3♀	"
C 480	24 Sept 1963	"	18 mi. E. of Peshawar on G. T. Rd.	<u>Bubalus bubalis</u>	3♂, 2♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 481	24 Sept 1963	Peshawar	46 mi. W. of Rawalpindi (on Peshawar Rd.)	<u>Bos indicus</u>	7♂, 4♀	V. C. McCarthy and Z. B. Mirza
C 483B	24 Sept 1963	Rawalpindi	13 mi. W. of Rawalpindi	<u>Bos indicus</u>	9♂	"
C 485	24 Sept 1963	Peshawar	18 mi. W. of Rawalpindi on Fateh Jang Rd.	<u>Ovis aries</u>	8♂, 2♀	"
C 487	25 Sept 1963	Rawalpindi	25 mi. NW of Rawalpindi (Taxilla-Haripur Rd.)	<u>Camelus dromedarius</u>	1♀	"
C 488B	25 Sept 1963	Peshawar	5 mi. SW of Haripur	<u>Bos indicus</u>	1♂, 1♀	"
C 489	26 Sept 1963	Rawalpindi	20 mi. NE of Rawalpindi (on Lehtrar Rd.)	<u>Capra hircus</u>	3♂, 1♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 490	26 Sept 1963	Rawalpindi	20 mi. NE of Rawalpindi (on Lehtrar Rd.)	<u>Ovis aries</u>	3♂, 1♀	V. C. McCarthy and Z. B. Mirza
C 492A	26 Sept 1963	"	18 mi. E. of Rawalpindi (on Azad K. Rd.)	<u>Bubalus bubalis</u>	4♂	"
C 493B	26 Sept 1963	"	"	<u>Capra hircus</u>	2♂, 4♀	"
C 494	27 Sept 1963	"	25 mi. SE of Rawalpindi (Jhelum Rd.)	<u>Ovis aries</u>	4♂, 1♀	"
C 495	27 Sept 1963	"	"	<u>Bos indicus</u>	3♂, 1♀	"
C 498B	16 Oct 1963	Multan	Gar, Taunsa Barrage	"	1♀	"
C 509	24 Oct 1963	Quetta	Chaman 4,000 ft.	<u>Capra hircus</u>	3♂, 1♀	"
C 518	7 Nov 1963	Karachi	10 mi. NW of Karachi	"	19♂, 17♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 519	7 Nov 1963	Karachi	10 mi. NW of Karachi	<u>Ovis aries</u>	1♂, 3♀	V. C. McCarthy and Z. B. Mirza
C 520	8 Nov 1963	"	Miani Beach 30 mi. NW of Karachi (Bela Rd.)	<u>Capra hircus</u>	3♂	"
C 523	9 Nov 1963	"	Karachi University	"	3♂, 8♀	"
C 529B	24 Apr 1964	Peshawar	Shangla, Swat State	<u>Bos indicus</u>	1♂	Traub Group
C 533B	3 May 1964	Rawalpindi	Kohala (2,000 ft.), NE of Murree on Kashmir Rd.	"	1♂, 1♀	"
C 537D	3 May 1964	Azad Kashmir	9 mi. NE of Kohala on Muzaffarabad Rd.	"	4♂	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 574A	13 June 1964	Quetta	Hindubagh, Zhob Dist.	<u>Bos indicus</u>	7♂	Traub Group
C 588A	13 June 1964 14 June 1964	"	"	<u>Ovis aries</u>	1♂, 1♀	"
C 597A	13 Aug 1964	Peshawar	Amandara, Malakand Agency, 3,750 ft.	<u>Camelus dromedarius</u>	3♂	"
C 599	17 Aug 1964	Peshawar	Chitral, Chitral State, 4,800 ft.	<u>Ovis aries</u>	1♂	"
C 602	18 Aug 1964	"	"	<u>Bos indicus</u>	1♂	"
C 654A	18 Apr 1964	Bahawalpur	Fort Abbas, Bahawalpur Dist.	"	1♀	"
C 655B	8 May 1964	Azad Kashmir	Muzaffara-bad	"	15♂, 14♀	"
C 663B	25 Jan 1964	Multan	Panjnad	"	6♂	"



TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 666A	1 Feb 1964	D. I. Khan	D. I. Khan	<u>Bos indicus</u>	16♂	Traub Group
C 670	3 Apr 1964	Lahore	Balloki, Lahore Dist.	"	7♂	"
C 714A	3 Oct 1964	"	Charwa, Sialkot Dist.	<u>Bubalus</u> <u>bubalis</u>	1♂	"
C 757A	8 Aug 1964	Peshawar	Naltar, Gilgit	<u>Capra hircus</u>	1♂	"
C 778	7 May 1964	Azad Kashmir	10 mi.S.of Muzaffarabad E.Bank-Jhelum	<u>Bos indicus</u>	2♂	"
C 783	9 Nov 1963	Karachi	Damba Goth, 15 mi.NE of Karachi on T. B. Khan Rd.	<u>Bos indicus</u>	3♂, 7♀	V. C. McCarthy and Z. B. Mirza
C 784A	9 Nov 1963	"	"	Off ground	1♂	"
C 785A	9 Nov 1963	"	16 mi. NE of Karachi on T. B. Khan Rd.	<u>Camelus</u> <u>dromedarius</u>	3♂	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 793A	13 Nov 1963	Hyderabad	8 mi. W. of Tatta (on Karachi Rd.)	<u>Camelus dromedarius</u>	7♂	V. C. McCarthy and Z. B. Mirza
C 795A	13 Nov 1963	"	Tatta	<u>Ovis aries</u>	1♂, 1♀	"
C 798A	16 Nov 1963	Multan	Shahwali, 10 mi. N. of Kashmor on D. G. Khan Rd.	<u>Bos indicus</u>	2♂, 2♀	"
C 802	18 Nov 1963	Bahawalpur	Bhung, 15 mi. E. of Kashmor	<u>Capra hircus</u>	2♀	"
C 803A	18 Nov 1963	"	"	<u>Ovis aries</u>	3♂, 1♀	"
C 804	18 Nov 1963	"	"	<u>Bos indicus</u>	10♂, 1♀	"
C 805	19 Nov 1963	Multan	5 mi. NW of Panjnad (on Muzaffargarh Rd.)	<u>Capra hircus</u>	2♂, 2♀	"
C 807	20 Nov 1963	"	7 mi. SW of Panjnad	"	4♂, 6♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 808	20 Nov 1963	Multan	7 mi. SW of Panjnad	<u>Ovis aries</u>	3♂, 4♀	V. C. McCarthy and Z. B. Mirza
C 809B	20 Nov 1963	"	"	<u>Bos indicus</u>	1♂, 2♀	"
C 814A	7 Feb 1964	Hyderabad	Nagar Parkar	"	8♂, 6♀	"
C 815	7 Feb 1964	"	7 mi. SE of Nagar Parkar	<u>Capra hircus</u>	1♂, 3♀	"
C 816	7 Feb 1964	"	"	<u>Ovis aries</u>	10♂, 2♀	"
C 818A	3 Mar 1964	Lahore	Balloki H. W., Lahore	<u>Bubalus bubalis</u>	7♂	"
C 821B	3 Mar 1964	"	6 mi. from Balloki H. W. on Lower Bari Doab Canal	<u>Centropus sinensis</u>	2♀	"
C 824A	19 Mar 1964	Multan	16 mi. E. of Taunsa Barrage, Rangpur Rd.	<u>Capra hircus</u>	14♂, 7♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 825A	19 Mar 1964	Multan	16 mi. E. of Taunsa Barrage, Rangpur Rd.	<u>Ovis aries</u>	11♂, 3♀	V. C. McCarthy and Z. B. Mirza
C 826	20 Mar 1964	"	15 mi. W. of Muzaffargarh	<u>Bos indicus</u>	37♂, 27♀	"
C 830B	24 Mar 1964	Quetta	15 mi. E. of Ft. Sandeman	<u>Lepus capensis tibetanus</u>	1♀	"
C 837A	29 Mar 1964	Kalat	5 mi. S. of Mastung (on Kalat Rd.)	<u>Bos indicus</u>	3♂, 5♀	"
C 842B	1 Apr 1964	"	2 mi. E. of Pangjur (on Kalat Rd.)	<u>Capra hircus</u>	9♂, 4♀	"
C 845A	3 Apr 1964	"	Hoshab	<u>Bos indicus</u>	2♂, 2♀	"
C 846	3 Apr 1964	"	"	<u>Ovis aries</u>	17♂, 7♀	"
C 847A	3 Apr 1964	"	"	<u>Capra hircus</u>	6♂, 17♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 850A	6 Apr 1964	Kalat	2 mi. SW of Surab (on Panjgur Rd.)	<u>Bos indicus</u>	3♂	V. C. McCarthy and Z. B. Mirza
C 852A	9 Apr 1964	Quetta	10 mi. N. of Rakhni (on Kingri Rd.)	<u>Ovis aries</u>	1♂	"
C 856C	3 Apr 1964	Kalat	Hoshab	<u>Camelus dromedarius</u>	2♀	"
C 857B	22 May 1964	Lahore	Changa Manga, Lahore Dist.	<u>Bos indicus</u>	15♂, 30♀	"
C 866A	28 June 1964	Azad Kashmir	Dhok, near Muzaffarabad	<u>Capra hircus</u>	2♀	Nazeer M. Khan and Z. B. Mirza
C 875A	13 July 1964	Lahore	Bagwat, Sialkot Dist.	<u>Bubalus bubalis</u>	4♂, 12♀	Z. B. Mirza
C 876B	13 July 1964	"	"	<u>Bos indicus</u>	1♂	"
C 896A	6 June 1963	"	Gujranwala Dist.	<u>Equus caballus</u>	1♂	Dept. of Animal Husbandry (West Pakistan)

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 897A	16 Oct 1963	Karachi	Hab Chowkei, near Karachi on Hab River Las Bela (Bela) Rd.	<u>Capra hircus</u>	24♂, 15♀	Dept. of Animal Husbandry (West Pakistan)
C 898	5 Oct 1963	Hyderabad	Jamesabad, Thar Parkar Dist.	"	5♂, 5♀	"
C 901A	19 Aug 1963	"	Matli, Hyderabad Dist.	<u>Camelus dromedarius</u>	3♂, 7♀	"
C 902	21 Aug 1963	"	"	<u>Bubalus bubalis</u>	19♂, 4♀	"
C 903A	14 Apr 1963	Rawalpindi	Rajajang, Rawalpindi Dist.	<u>Bos indicus</u>	18♂, 17♀	"
C 904A	1963	Sargodha	Shahpur, Mianwali Dist.	<u>Bubalus bubalis</u>	1♂, 6♀	"
C 905	12 April 1964	Lahore	Kanganpur, Lahore Dist.	<u>Bos indicus</u>	3♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 906	24 Aug 1963	Khairpur	Ubauro, Sukkur Dist.	<u>Equus caballus</u>	48♂, 27♀	Dept. of Animal Husbandry (West Pakistan)
C 907A	24 Aug 1963	"	"	<u>Bubalus bubalis</u>	28♂, 27♀	"
C 908A	22 Apr 1963	Lahore	Kasur, Lahore Dist.	<u>Bos indicus</u>	3♂, 1♀	"
C 909A	8 June 1963	"	Gujranwala, 42 mi. N. of Lahore	<u>Capra hircus</u>	15♂, 2♀	"
C 910	June 1963	"	Nankana Sahib, 45 mi. W. of Lahore	<u>Bos indicus</u>	8♂, 2♀	"
C 911A	22 Apr 1963	"	Kasur, Lahore Dist.	<u>Bubalus bubalis</u>	4♂, 3♀	"
C 912A	1963	"	Akalgarh, Gujranwala Dist.	Poultry (?? probably from poultry yard)	2♂	"
C 913A	6 June 1963	"	Gujranwala	<u>Bos indicus</u>	19♂, 11♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 913A	6 June 1963	Lahore	Gujranwala	<u>Bos indicus</u>	19♂, 11♀	Dept. of Animal Husbandry (West Pakistan)
C 914	21 July 1963	Rawalpindi	Pind Dadan Khan, Jhelum Dist. (W. bank)	<u>Equus caballus</u>	32♂, 29♀	"
C 915A	22 July 1963	"	"	<u>Bubalus bubalis</u>	8♂, 1♀	"
C 917	16 June 1963	Lahore	Gujranwala	<u>Ovis aries</u>	34♂, 30♀	"
C 918A	28 Aug 1963	Karachi	Hab Chowki, near Hab River on Bela Rd.	<u>Bos indicus</u>	9♂, 8♀	"
C 919A	23 May 1963	Sargodha	Mianwali	<u>Bubalus bubalis</u>	15♂, 17♀	"
C 920B	25 May 1963	"	"	<u>Camelus dromedarius</u>	3♂, 3♀	"



TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 921A	1963	Sargodha	Shahpur City Mianwali	<u>Bos indicus</u>	1♀	Dept. of Animal Husbandry (West Pakistan)
C 923	9 Apr 1963	Lahore	Gujranwala	<u>Equus caballus</u>	7♂, 7♀	"
C 924	1963	"	Pindi Bhat-tian, Gujran-wala Dist.	<u>Bubalus bubalis</u>	8♂, 5♀	"
C 925	19 Sept 1963	Hyderabad	Mirpur Khas, Dist. Thar Parkar	<u>Bos indicus</u>	10♂, 14♀	"
C 929	25 Sept 1963	"	Tando Ghulam Ali, Hyderabad Dist.	<u>Camelus dromedarius</u>	2♂, 1♀	"
C 930A	31 Aug 1963	Karachi	Karachi	<u>Bos indicus</u>	6♂, 1♀	"
C 933	16 Sept 1963	Hyderabad	Mirpur Khas, Thar Parkar Dist.	"	10♂, 4♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 934	16 Sept 1963	Hyderabad	Mirpur Khas, Thar Parkar Dist.	<u>Equus caballus</u>	2♂, 4♀	Dept. of Animal Husbandry (West Pakistan)
C 937	3 Oct 1963	"	Tando Ghulam Ali, Hyderabad	"	2♂, 1♀	"
C 938	16 Oct 1963	Karachi	Hab Chowki (Bela Rd., Hab River) Karachi	<u>Capra hircus</u>	11♂, 8♀	"
C 939A	17 Oct 1963	"	"	<u>Ovis aries</u>	54♂, 28♀	"
C 942	21 Apr 1963	Lahore	Naushera Vir Khan, Gujranwala Dist.	<u>Bubalus bubalis</u>	110♂, 38♀	"
C 943	12 Apr 1963	"	Kanganpur, Lahore Dist.	"	2♂, 2♀	"
C 944A	24 Aug 1963	Khairpur	Ubauro, Sukkur Dist.	<u>Bos indicus</u>	50♂, 38♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 945	20 July 1963	Rawalpindi	Pind Dadan Khan, Jhelum Dist.	<u>Bos indicus</u>	22♂, 36♀	Dept. of Animal Husbandry (West Pakistan)
C 946	12 Apr 1963	Lahore	Raja Jang, Lahore Dist.	<u>Equus caballus</u>	13♂, 5♀	"
C 947A	20 Aug 1963	Karachi	Uthal, Las Bela Dist.	<u>Camelus dromedarius</u>	1♀	"
C 948A	8 June 1963	Sargodha	Mianwali, Sargodha Dist.	"	4♂, 2♀	"
C 950A	7 June 1963	"	"	<u>Bos indicus</u>	138♂, 80♀	"
C 951	8 Aug 1963	Khairpur	Pano Akil	<u>Bubalus bubalis</u>	7♂, 2♀	"
C 952	20 Aug 1963	"	Gotki, Sukkur Dist.	<u>Bos indicus</u>	30♂, 20♀	"
C 953	11 Apr 1963	Lahore	Gujranwala	<u>Bubalus bubalis</u>	51♂, 40♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 954A	5 May 1963	Sargodha	Mianwali, Sargodha Dist.	<u>Bos indicus</u>	57♂, 54♀	Dept. of Animal Husbandry (West Pakistan)
C 956	15 Apr 1963	Lahore	Gujranwala	"	13♂, 15♀	"
C 957A	19 Aug 1963	Hyderabad	Matli, Hyderabad Dist.	"	20♂, 6♀	"
C 958	16 Oct 1963	Karachi	Hab Chowki near Karachi (Hab River on Bela Rd.)	<u>Capra hircus</u>	24♂, 9♀	"
C 960	7 June 1963	Lahore	Wazirabad, Lahore Dist.	<u>Bos indicus</u>	7♂, 7♀	"
C 961	4 Apr 1963	Sargodha	Jaranwala, Lyallpur Dist.	"	17♂, 22♀	"
C 962	12 June 1963	Lahore	Gujranwala	"	20♂, 14♀	"
C 964A	21 July 1963	Rawalpindi	Pind Dadan Khan, Jhelum Dist.	<u>Camelus dromedarius</u>	2♂, 1♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 965	18 Aug 1963	Khairpur	Ghotki, Sukkur Dist.	<u>Bos indicus</u>	18♂, 7♀	Dept. of Animal Husbandry (West Pakistan)
C 966A	6 June 1963	Sargodha	Mianwali, Sargodha Dist.	<u>Equus caballus</u>	57♂, 34♀	"
C 968	21 Aug 1963	Hyderabad	Pano Akil, Hyderabad Dist.	"	7♂, 5♀	"
C 969A	20 Aug 1963	Karachi	Uthal, Las Bela Dist.	<u>Bos indicus</u>	11♂, 13♀	"
C 971B	27 May 1963	Rawalpindi	Chakwal, Jhelum Dist.	"	20♂, 31♀	"
C 972	20 Aug 1963	Khairpur	Ghotki, Sukkur Dist.	"	26♂, 18♀	"
C 973	1963	Sargodha	Shahpur, Mianwali Dist.	<u>Bubalus bubalis</u>	4♂, 12♀	"
C 975	1963	Rawalpindi	Jhelum	<u>Bos indicus</u>	5♂	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 976	21 Aug 1963	Hyderabad	Pano Akil, Hyderabad Dist.	<u>Bos indicus</u>	6♂, 1♀	Dept. of Animal Husbandry (West Pakistan)
C 977A	2 May 1963	Lahore	Lahore Dist.	<u>Bubalus bubalis</u> and <u>Bos indicus</u>	41♂, 12♀	"
C 978	1963	Sargodha	Shahpur, Mianwali Dist.	<u>Bos indicus</u>	3♂, 9♀	"
C 979A	19 Aug 1963	Lahore	Tajpura, 8 mi. SE of Lahore (Harike Rd.)	<u>Bubalus bubalis</u>	12♂, 8♀	Nazeer M. Khan
C 980A	19 Aug 1963	"	Pir Naseer (1 mi. from Harbanspura, 8 mi. E. of Lahore on canal)	"	12♂, 11♀	"
C 983A	20 Aug 1963	"	11 mi. SE of Lahore on Harike Rd.	"	19♂, 17♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 985A	20 Aug 1963	Lahore	Paddri, 8 mi. SE of Lahore on Harike Rd.	<u>Bubalus bubalis</u>	64♂, 40♀	Nazeer M. Khan
C 986A	20 Aug 1963	"	"	<u>Lepus nigricollis</u>	1♂	"
C 987A	20 Aug 1963	"	"	<u>Bubalus bubalis</u>	28♂, 20♀	"
C 988B	21 Aug 1963	"	Forest, 15 mi. SE of Lahore on Harike Rd.	<u>Vulpes bengalensis</u>	2♂	"
C 989A	21 Aug 1963	"	Korian, 14 mi. SE of Lahore on Harike Rd.	<u>Bubalus bubalis</u>	3♂	"
C 990B	21 Aug 1963	"	Forest 15 mi. SE of Lahore on Harike Rd.	<u>Vulpes bengalensis</u>	1♂	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 992A	22 Aug 1963	Lahore	Harbans-pura Forest, 8 mi. E. of Lahore	<u>Vulpes bengalensis</u>	20♂, 5♀	Nazeer M. Khan
C 996A	29 Aug 1963	"	Balloki, 40 mi. SW of Lahore	<u>Bubalus bubalis</u>	5♂, 2♀	"
C 997A	29 Aug 1963	"	Thata Khokhar, near Balloki, Lahore Dist.	"	5♂, 13♀	"
C 1001A	30 Aug 1963	"	8 mi. SW of Balloki, Lahore Dist.	<u>Camelus dromedarius</u>	1♂	"
C 1004A	30 Aug 1963	"	Attari, 8 mi. SW of Balloki, Lahore Dist.	<u>Bos indicus</u>	1♀	"
C 1017	9 Sept 1963	"	13 mi. SE of Lahore on Harike Rd. Jallo	"	4♂	"



TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1018	9 Sept 1963	Lahore	Lakhanke, 16 mi. E. of Lahore on Wagah Rd.	<u>Bos indicus</u>	4♂, 2♀	Nazeer M. Khan
C 1019A	9 Sept 1963	"	Lakhanke, 16 mi. E. of Lahore on Wagah Rd.	<u>Bubalus bubalis</u>	2♂, 5♀	"
C 1020A	9 Sept 1963	"	Dial, 18 mi. E. of Lahore, Wagah Rd.	"	2♂, 5♀	"
C 1021A	10 Sept 1963	"	Wagah, 19 mi. E. of Lahore on Amritsar Border	"	4♂, 1♀	"
C 1022A	10 Sept 1963	"	"	<u>Bos indicus</u>	7♂, 5♀	"
C 1023A	10 Sept 1963	"	Pathe, 14 mi. E. of Lahore, on Amritsar Railway	<u>Bubalus bubalis</u>	10♂, 8♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1024A	11 Sept 1963	Lahore	Barki, 17 mi. SE of Lahore (Harike Rd.)	<u>Bos indicus</u>	14♂, 8♀	Nazeer M. Khan
C 1025A	11 Sept 1963	"	Santpura, 20 mi. SE of Lahore (Harike Rd.)	"	21♂, 4♀	"
C 1026A	11 Sept 1963	"	Karbath, 17 mi. SE of Lahore (Harike Rd. near Bakki)	"	2♂, 1♀	"
C 1027A	11 Sept 1963	"	Hare, 17 mi. SE of Lahore (Harike Rd. Area)	"	5♂, 5♀	"
C 1028A	12 Sept 1963	"	Wara Shadi, 17 mi. SE of Lahore (Harike Rd. Area)	<u>Bubalus bubalis</u>	13♂, 6♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1029A	12 Sept 1963	Lahore	Murpur, 17 mi. SE of Lahore (Harike Rd. area)	<u>Bubalus bubalis</u>	4♂, 4♀	Nazeer M. Khan
C 1030A	12 Sept 1963	"	Barka, 20 mi. SE of Lahore (Harike Rd.)	"	1♂, 1♀	"
C 1031A	13 Sept 1963	"	Attari Saroba, 12 mi. SSE of Lahore (Ferozepur Rd.)	"	5♂, 1♀	"
C 1032A	13 Sept 1963	"	Jaade, 15 mi. SSE of Lahore (Ferozepur Rd.)	"	9♂, 3♀	"
C 1033A	13 Sept 1963	"	Kulleki, 13 mi. SSE of Lahore (Ferozepur Rd.)	"	9♂, 3♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1034A	13 Sept 1963	Lahore	Shahzada, 13 mi. SSE of Lahore (Ferozepur Rd.)	<u>Bubalus bubalis</u>	37♂, 13♀	Nazeer M. Khan
C 1035	13 Sept 1963	"	Purana Khana, 15 mi. SSE of Lahore (Ferozepur Rd.)	"	10♂, 2♀	"
C 1036A	13 Sept 1963	"	Khoka, 19 mi. SSE of Lahore (Ferozepur Rd.)	"	4♂, 5♀	"
C 1037	13 Sept 1963	"	Jhulka, 23 mi. SSE of Lahore (Ferozepur Rd.)	"	16♂, 21♀	"
C 1038A	13 Sept 1963	"	Khana Nao, 13 mi. SSE of Lahore (Ferozepur Rd.)	"	17♂, 12♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1039A	13 Sept 1963	Lahore	Bajn Matta, 11 mi. SSE of Lahore (Ferozepur Rd.)	<u>Bubalus bubalis</u>	20♂, 12♀	Nazeer M. Khan
C 1040A	13 Sept 1963	"	Kodde, 5 mi. S. of Lahore Cantt.	"	30♂, 5♀	"
C 1041A	14 Sept 1963	"	Bahaddarpura 12 mi. SW of Kasur, (Chunian Rd.) Lahore Dist.	"	7♂, 2♀	"
C 1042	14 Sept 1963	"	Fathepura, 19 mi. SW of Kasur, (Chunian Rd.) Lahore Dist.	"	12♂, 4♀	"
C 1043A	14 Sept 1963	"	Dhollan, 20 mi. SW of Kasur, (Chunian Rd.) Lahore Dist.	<u>Bos indicus</u>	8♂, 8♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1044A	14 Sept 1963	Lahore	Bakkarke, 19 mi. SW of Kasur, 4 mi. from border	<u>Bubalus bubalis</u>	1♂	Nazeer M. Khan
C 1045A	15 Sept 1963	"	Gandian, 19 mi. SW of Kasur	"	3♂, 1♀	"
C 1046A	15 Sept 1963	"	Kasur, 34 mi. SSE of Lahore (Ferozepur Rd.)	"	7♂	"
C 1047A	16 Sept 1963	"	Aasil, 26 mi. S. of Lahore (Ferozepur Rd.)	"	6♂, 3♀	"
C 1048	17 Sept 1963	"	Changa Manga Forest 40 mi. SSW of Lahore	Nilgai <u>Boselaphus tragocamelus</u>	1♂	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1049A	17 Sept 1963	Lahore	Changa Manga Forest, 40 mi. SSW of Lahore	<u>Equus caballus</u>	1♂	Nazeer M. Khan
C 1053A	21 Sept 1963	"	Balloki H. W., 40 mi. SW of Lahore	<u>Bubalus bubalis</u>	4♂	"
C 1054A	24 Sept 1963	"	Ferozewala, 6 mi. N. of Lahore (Gujranwala Rd.)	"	12♂, 6♀	"
C 1057	25 Sept 1963	"	Sharakpur Khuro, 8 mi. NW of Lahore (Lyallpur Rd.)	"	8♂, 2♀	"
C 1059A	25 Sept 1963	"	Kot Abdul Malik, 11 mi. NW of Lahore-Sheikhupura Rd.	<u>Bos indicus</u>	1♂, 1♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1060	25 Sept 1963	Lahore	Kot Abdul Malik, 11 mi. NW of Lahore (Sheikhupura Rd.)	<u>Bubalus bubalis</u>	73♂, 28♀	Nazeer M. Khan
C 1061A	26 Sept 1963	"	Khaki, 16 mi. NW of Lahore (Lyalpur Rd.)	<u>Bos indicus</u>	12♂, 10♀	"
C 1063A	26 Sept 1963	"	Budhoke, 10 mi. NW of Lahore (Lyalpur Rd.)	<u>Bubalus bubalis</u>	2♂, 2♀	"
C 1064	26 Sept 1963	"	"	<u>Bos indicus</u>	20♂, 4♀	"
C 1066	16 Oct 1963	"	Wagah, 19 mi. E. of Lahore, on border	"	20♂, 7♀	"
C 1067A	16 Oct 1963	"	Talwara, 15 mi. E. of Lahore (Wagah Rd.)	<u>Bubalus bubalis</u>	16♂, 9♀	"



TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1068A	16 Oct 1963	Lahore	Talwara, 15 mi. E. of Lahore (Wagah Rd.)	<u>Bos indicus</u>	4♂, 4♀	Nazeer M. Khan
C 1069A	17 Oct 1963	"	10 mi. E. of Lahore (Wagah Rd.) Marlmari	<u>Bubalus bubalis</u>	11♂, 1♀	"
C 1070A	17 Oct 1963	"	10 mi. E. of Lahore (Wagah Rd.) Marlmari	<u>Bos indicus</u>	8♂, 3♀	"
C 1071	17 Oct 1963	"	Nath, 13 mi. E. of Lahore on Wagah Rd.	"	17♂, 5♀	"
C 1072A	17 Oct 1963	"	Kotli, 12 mi. E. of Lahore (Wagah Rd.)	<u>Ovis aries</u>	3♂, 1♀	"
C 1073A	17 Oct 1963	"	Manawan, 12 mi. E. of Lahore (Wagah Rd.)	<u>Bubalus bubalis</u>	12♂, 4♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1074B	17 Oct 1963	Lahore	Narang, 24 mi. NE of Lahore (on Shahdara-Narang R. W. L.)	<u>Bos indicus</u>	1♂, 4♀	Nazeer M. Khan
C 1075B	17 Oct 1963	"	"	<u>Bubalus bubalis</u>	2♂	"
C 1076	18 Oct 1963	"	Karol, 29 mi. NE of Lahore (Shahdara-Narang Rd.)	"	14♂, 5♀	"
C 1077	18 Oct 1963	"	Passianwala, 34 mi. NE of Lahore (Shahdara-Narang Rd.)	"	10♂, 22♀	"
C 1078A	18 Oct 1963	"	Bheni, 38 mi. NE of Lahore (Shahdara-Narang Rd.)	"	32♂, 24♀	"
C 1079B	18 Oct 1963	"	"	<u>Bos indicus</u>	23♂, 14♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1080A	18 Oct 1963	Lahore	Kakkeki, 42 mi. NE of Lahore (Shah-dara-Narang Rd.)	<u>Bos indicus</u>	16♂, 6♀	Nazeer M. Khan
C 1081	18 Oct 1963	"	Talwara, 24 mi. NE of Lahore (Shah-dara-Narang Rd.)	"	18♂, 7♀	"
C 1082A	18 Oct 1963	"	"	<u>Bubalus bubalis</u>	66♂, 26♀	"
C 1083A	19 Oct 1963	"	Lahore City	"	8♂, 4♀	"
C 1084A	19 Oct 1963	"	"	"	29♂, 8♀	"
C 1085	19 Oct 1963	"	"	"	7♂, 7♀	"
C 1086	19 Oct 1963	"	"	"	12♂, 11♀	"
C 1088	1 Nov 1963	"	Gujranwala	"	5♂, 3♀	"
C 1089A	1 Nov 1963	"	"	"	4♂, 3♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1090	1 Nov 1963	Lahore	Gujranwala	<u>Bos indicus</u>	11♂	Nazeer M. Khan
C 1091	2 Nov 1963	"	Narowal, 48 mi. NE of Lahore	<u>Bubalus bubalis</u>	6♂, 3♀	"
C 1093A	4 Nov 1963	"	Shakargarh, 35 mi. ESE of Sialkot	"	4♂, 1♀	"
C 1096A	4 Nov 1963	"	Chandra, 8 mi. N. of Narowal, Sialkot Dist.	"	4♀	"
C 1097A	5 Nov 1963	"	Alipur, 34 mi. SE of Sialkot	"	1♂, 1♀	"
C 1098A	5 Nov 1963	"	Gunna, 8 mi. SSE of Sialkot	"	10♂	"
C 1099	6 Nov 1963	"	Aalus Kalan, 12 mi. W. of Sialkot (Gujranwala Rd.)	"	8♂, 8♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1100	7 Nov 1963	Lahore	Sialkot	<u>Bubalus bubalis</u>	9♂, 9♀	Nazeer M. Khan
C 1102A	8 Nov 1963	"	Hafizabad, 31 mi. W. of Gujranwala	"	11♂, 3♀	"
C 1103A	8 Nov 1963	"	26 mi. W. of Gujranwala	"	3♂, 3♀	"
C 1104A	8 Nov 1963	"	Gujranwala	"	10♂, 4♀	"
C 1105A	11 Nov 1963	"	Pindi Bhat-tain, 44 mi. WNW of Sheik-hupura, Gujranwala Dist.	"	3♂	"
C 1106A	11 Nov 1963	"	"	<u>Bos indicus</u>	26♂, 5♀	"
C 1107	12 Nov 1963	"	8 mi. from Pindi Bhat-tain, 36 mi. WNW of Sheik-hupura (on Sheik-hupura Rd.)	<u>Bubalus bubalis</u>	9♂, 4♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1108A	12 Nov 1963	Lahore	13 mi. from Pindi Bhattain (on Sheikhupura Rd.) 31 mi. WNW of Sheikhupura	<u>Bubalus bubalis</u>	10♂, 1♀	Nazeer M. Khan
C 1109A	13 Nov 1963	"	"	<u>Bos indicus</u>	2♂, 2♀	"
C 1110	13 Nov 1963	"	20 mi. from Pindi Bhattain (on Sheikhupura Rd.) 24 mi. WNW of Sheikhupura	<u>Bubalus bubalis</u>	10♂, 5♀	"
C 1111B	13 Nov 1963	"	"	<u>Bos indicus</u>	2♂	"
C 1112B	14 Nov 1963	Sargodha	Tandianwala, 30 mi. S. of Lyallpur	<u>Bubalus bubalis</u>	2♂, 3♀	"
C 1113B	14 Nov 1963	"	"	<u>Bos indicus</u>	2♂	"
C 1114	14 Nov 1963	"	Kot Shah Mohd., 18 mi. S. of Lyallpur	<u>Bubalus bubalis</u>	5♂, 1♀	"
C 1115B	15 Nov 1963	"	27 mi. E. of Lyallpur (Sheikhupura Rd.)	"	6♂	"
C 1116B	16 Nov 1963	"	Jaranwala, 23 mi. SE of Lyallpur (Lahore Rd.)	"	2♂, 2♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1117B	16 Nov 1963	Sargodha	Jaranwala, 23 mi. SE of Lyallpur (Lahore Rd.)	<u>Bos indicus</u>	3♂	Nazeer M. Khan
C 1118B	16 Nov 1963	"	8 mi. NW of Jaranwala (on Lyallpur Rd.)	<u>Bubalus bubalis</u>	8♂	"
C 1119A	16 Nov 1963	"	"	<u>Bos indicus</u>	2♂, 3♀	"
C 1120B	16 Nov 1963	"	24 mi. NW of Jaranwala (on Lyallpur Rd.)	"	3♂	"
C 1121	16 Nov 1963	"	"	<u>Bubalus bubalis</u>	16♂, 8♀	"
C 1122A	16 Nov 1963	Lahore	16 mi. SW of Lahore (Sharqpur Rd.)	"	5♂	"
C 1132A	4 Dec 1963	"	12 mi. SE of Lahore (Harike Rd.)	"	4♂, 1♀	"
C 1133	4 Dec 1963	"	"	<u>Bos indicus</u>	4♂, 2♀	"
C 1138A	5 Dec 1963	"	7 mi. SW of Lahore (Multan Rd.)	<u>Bubalus bubalis</u>	4♂	"
C 1139A	5 Dec 1963	"	8 mi. SW of Lahore (Multan Rd.)	"	24♂, 4♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1140A	6 Dec 1963	Lahore	21 mi. SE of Lahore (Harike Rd.)	<u>Bubalus bubalis</u>	1♂	Nazeer M. Khan
C 1144B	6 Dec 1963	"	10 mi. SE of Lahore (Harike Rd.)	"	9♂, 3♀	"
C 1145B	6 Dec 1963	"	"	<u>Bos indicus</u>	3♂	"
C 1147	9 Dec 1963	"	Sheikhupura City, 24 mi. NW of Lahore	"	11♂	"
C 1148	9 Dec 1963	"	5 mi. SE of Sheikhupura (Lahore Rd.)	<u>Bubalus bubalis</u>	7♂, 1♀	"
C 1149	9 Dec 1963	"	"	<u>Bos indicus</u>	23♂	"
C 1150	9 Dec 1963	"	11 mi. SE of Sheikhupura (Lahore Rd.)	<u>Bubalus bubalis</u>	8♂	"
C 1151A	9 Dec 1963	"	19 mi. SE of Sheikhupura (Lahore Rd.)	"	5♂	"
C 1152A	9 Dec 1963	"	"	<u>Bos indicus</u>	1♂	"
C 1153	9 Dec 1963	"	20 mi. SE of Sheikhupura (Lahore Rd.)	<u>Bubalus bubalis</u>	3♂	"



TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1155A	23 Dec 1963	Lahore	12 mi. SE of Lahore (Harike Rd.)	<u>Bubalus bubalis</u>	1♂	Nazeer M. Khan
C 1158B	23 Dec 1963	"	25 mi. SE of Lahore (Harike Rd.)	<u>Bos indicus</u>	1♂	"
C 1160B	23 Dec 1963	"	19 mi. E. of Lahore (near Wagah Border)	<u>Bubalus bubalis</u>	3♂	"
C 1162A	24 Dec 1963	"	Dhori, 20 mi. SE of Lahore (Harike Rd.)	"	2♂	"
C 1163	24 Dec 1963	"	"	<u>Bos indicus</u>	6♂, 1♀	"
C 1164B	24 Dec 1963	"	Mandianwala, 15 mi. SE of Lahore (Harike Rd.)	"	1♂	"
C 1165B	24 Dec 1963	"	Mandianwala, 15 mi. SE of Lahore (Harike Rd.)	<u>Bubalus bubalis</u>	1♂	"
C 1168A	27 Dec 1963	"	Barka, 17 mi. SE of Lahore (Harike Rd.)	"	5♂	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1169A	27 Dec 1963	Lahore	Barka, 20 mi. SE of Lahore (Harike Rd.)	<u>Bubalus bubalis</u>	1♂	Nazeer M. Khan
C 1170	27 Dec 1963	"	"	<u>Bos indicus</u>	4♂	"
C 1171	28 Dec 1963	"	Paddana, 4 mi. from border (on Harike Rd.)	"	13♂	"
C 1172A	28 Dec 1963	"	Karanke, 7 mi. from border (Harike Rd.) Lahore Dist.	"	1♂	"
C 1173	28 Dec 1963	"	"	"	6♂	"
C 1174A	29 Dec 1963	"	Mojoke, 9 mi. from border (Harike Rd.)	"	3♂	"
C 1175A	29 Dec 1963	"	Narwar, 4 mi. S. of Wagah Border	"	15♂	"
C 1176A	29 Dec 1963	"	Dhoori, 6 mi. N. of 21 mi. marker from Lahore	"	6♂	"
C 1177	30 Dec 1963	"	Amar Siddu, 9 mi. S. of Lahore (Ferozepur Rd.)	<u>Bubalus bubalis</u>	4♂	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1179	30 Dec 1963	Lahore	14 mi. S. of Lahore (Ferozepur Rd.)	<u>Bubalus bubalis</u>	7♂	Nazeer M. Khan
C 1180A	30 Dec 1963	"	10 mi. S. of Lahore	"	2♂	"
C 1181	30 Dec 1963	"	12 mi. SE of Lahore (Harike Rd.)	"	1♂, 1♀	"
C 1184	10 Jan 1964	"	23 mi. S. of Lahore (Ferozepur Rd.) 6 mi. SW of 19 mi. marker	"	4♂	"
C 1188A	5 Feb 1964	Hyderabad	Umarkot, Thar Parkar Dist.	"	1♀	"
C 1190A	5 Feb 1964	"	Kerla, 30 mi. E. of Umarkot, Thar Parkar Dist.	<u>Capra hircus</u>	6♂, 2♀	"
C 1191A	5 Feb 1964	"	Chanana, 24 mi. E. of Umarkot, Thar Parkar Dist.	<u>Camelus dromedarius</u>	1♂	"
C 1192A	5 Feb 1964	"	Khokhropar, 38 mi. NE of Umarkot	<u>Bos indicus</u>	4♂, 3♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1201	7 Feb 1964	Hyderabad	Balar, 24 mi. N. of Umarmkot, Thar Parkar Dist.	<u>Bubalus bubalis</u>	1♂, 5♀	Nazeer M. Khan
C 1203B	7 Feb 1964	"	11 mi. NE of Umarmkot, Thar Parkar Dist.	<u>Camelus dromedarius</u>	1♀	"
C 1208	7 Feb 1964	"	Jagirwala, 10 mi. NE of Umarmkot, Thar Parkar Dist.	<u>Bubalus bubalis</u>	5♂, 2♀	"
C 1210A	7 Feb 1964	"	"	<u>Capra hircus</u>	1♀	"
C 1211	7 Feb 1964	"	16 mi. NE of Umarmkot, Thar Parkar Dist.	"	8♂	"
C 1213A	7 Feb 1964	"	Umarmkot, Thar Parkar Dist.	"	1♂, 1♀	"
C 1215A	7 Feb 1964	"	7 mi. W. of Umarmkot, Thar Parkar Dist.	<u>Camelus dromedarius</u>	4♂	"
C 1218	8 Feb 1964	"	Umarmkot, Thar Parkar Dist.	<u>Herpestes auropunctatus</u>	1♂	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1219A	8 Feb 1964	Hyderabad	Goth Soofi, 7 mi. W. of Umarmkot, Thar Parkar Dist.	<u>Equus caballus</u>	1♂	Nazeer M. Khan
C 1224A	23 Feb 1964	Lahore	17 mi. SE of Lahore (Harike Rd.)	<u>Bubalus bubalis</u>	3♂, 4♀	"
C 1225	27 Feb 1964	"	10 mi. SE of Lahore (Harike Rd.)	"	7♂, 1♀	"
C 1226A	27 Feb 1964	"	12 mi. SSE of Lahore	"	16♂, 7♀	"
C 1227A	27 Feb 1964	"	Malikpur, 13 mi. SE of Lahore (1 mi. S. of Harike Rd.)	"	23♂, 13♀	"
C 1228A	27 Feb 1964	"	Malikpur, 13 mi. SE of Lahore (1 mi. S. of Harike Rd.)	<u>Capra hircus</u>	1♂	"
C 1237	11 Mar 1964	Rawalpindi	25 mi. NE of Rawalpindi (Murree Rd.), 4,000 ft.	<u>Camelus dromedarius</u>	9♂, 3♀	"
C 1240	11 Mar 1964	"	Chirrah, 18 mi. NE of Rawalpindi (Lehtrar Rd.)	<u>Ovis aries</u>	3♂, 1♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1243	12 Mar 1964	Rawalpindi	Panjar, 30 mi. E. of Rawalpindi	<u>Bubalus bubalis</u>	6♂, 14♀	Nazeer M. Khan
C 1244	12 Mar 1964	Azad Kashmir	35 mi. E. of Rawalpindi, Dobeiren	"	5♂, 2♀	"
C 1259A	16 Mar 1964	Rawalpindi	Karpa, 18 mi. NE of Rawalpindi (Lehtrar Rd.)	<u>Ovis aries</u>	26♂, 7♀	"
C 1260A	16 Mar 1964	"	"	<u>Bos indicus</u>	2♂, 1♀	"
C 1262A	18 Mar 1964	Peshawar	Mansehra, 50 mi. N. of Rawalpindi	<u>Bubalus bubalis</u>	1♂, 1♀	"
C 1264	18 Mar 1964	"	5 mi. W. of Mansehra	"	3♂, 2♀	"
C 1270A	24 Mar 1964	"	Mardan City	<u>Camelus dromedarius</u>	8♂, 4♀	"
C 1268B	19 Mar 1964	"	8 mi. NW of Mansehra (Oghi Rd.)	<u>Bubalus bubalis</u>	3♂, 1♀	"
C 1271A	24 Mar 1964	"	Mardan City	<u>Capra hircus</u>	7♂, 1♀	"
C 1272A	24 Mar 1964	"	"	<u>Ovis aries</u>	1♂	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1273B	24 Mar 1964	Peshawar	Mardan City	<u>Bos indicus</u>	3♂, 3♀	Nazeer M. Khan
C 1275A	25 Mar 1964	"	Swabi, 29 mi. E. of Mardan	"	33♂, 17♀	"
C 1276A	25 Mar 1964	"	"	<u>Ovis aries</u>	1♂, 1♀	"
C 1277A	25 Mar 1964	"	Shah Mansur, 11 mi. from Swabi, Mardan Dist.	"	7♂, 7♀	"
C 1278A	25 Mar 1964	"	"	<u>Bos indicus</u>	1♂, 1♀	"
C 1279A	26 Mar 1964	"	"	<u>Capra hircus</u>	5♂, 4♀	"
C 1282B	26 Mar 1964	"	15 mi. NW of Mardan (Swat Rd.)	<u>Ovis aries</u>	1♂	"
C 1283	26 Mar 1964	"	"	<u>Bos indicus</u>	18♂, 8♀	"
C 1286A	28 Mar 1964	"	24 mi. NW of Mardan (Swat Rd.)	<u>Ovis aries</u>	2♂, 6♀	"
C 1287A	28 Mar 1964	"	Malakand Town	<u>Bos indicus</u>	5♂, 3♀	"
C 1289	29 Mar 1964	"	"	<u>Capra hircus</u>	9♂, 2♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1290B	30 Mar 1964	Peshawar	Mardan City	<u>Ovis aries</u>	13♂, 7♀	Nazeer M. Khan
C 1292A	30 Mar 1964	"	13 mi. S. of Mardan	<u>Bos indicus</u>	5♂, 5♀	"
C 1297	20 Apr 1964	Lahore	13 mi. E. of Lahore (Wagah Rd.)	<u>Ovis aries</u>	9♂	"
C 1298A	20 Apr 1964	"	"	<u>Bubalus bubalis</u>	12♂, 18♀	"
C 1299A	20 Apr 1964	"	16 mi. E. of Lahore (Wagah Rd.)	<u>Bos indicus</u>	3♂, 3♀	"
C 1300A	28 Apr 1964	"	Balloki, Lahore Dist.	<u>Bubalus bubalis</u>	11♂, 3♀	"
C 1307A	29 Apr 1964	"	Balloki H. W.	"	1♂	"
C 1308A	29 Apr 1964	"	Aulakh, Balloki H. W. area, Lahore Dist.	"	7♂	"
C 1309A	8 May 1964	"	13 mi. E. of Lahore (Wagah Rd.)	<u>Ovis aries</u>	9♂, 7♀	"
C 1310A	8 May 1964	"	15 mi. E. of Lahore (Wagah Rd.)	<u>Bubalus bubalis</u>	2♂, 2♀	"



TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1311A	8 May 1964	Lahore	17 mi. E. of Lahore (Wagah Rd.)	<u>Bubalus bubalis</u>	6♂, 5♀	Nazeer M. Khan
C 1313A	13 May 1964	"	Paddri, 21 mi. SE of Lahore (Harike Rd.)	<u>Capra hircus</u>	5♂, 1♀	"
C 1315A	13 May 1964	"	18 mi. SE of Lahore (Harike Rd.)	<u>Bubalus bubalis</u>	5♂	"
C 1317	21 May 1964	"	Mahmood Booti, 8 mi. N. of Lahore	"	5♂	"
C 1318A	21 May 1964	"	Sagian, 9 mi. N. of Lahore	<u>Bos indicus</u>	13♂, 5♀	"
C 1319	21 May 1964	"	Rat Garh, 10 mi. NNE of Lahore	<u>Bubalus bubalis</u>	4♂	"
C 1322A	25 May 1964	"	11 mi. NE of Lahore	<u>Ovis aries</u>	1♂	"
C 1323A	25 May 1964	"	"	<u>Bubalus bubalis</u>	1♂	"
C 1326	26 May 1964	"	12 mi. NE of Lahore	<u>Lepus nigricollis</u>	1♂, 1♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1327	26 May 1964	Lahore	12 mi. NE of Lahore	<u>Canis aureus</u>	3♂	Nazeer M. Khan
C 1330A	26 May 1964	"	"	<u>Bubalus bubalis</u>	7♂, 2♀	"
C 1331	27 May 1964	"	Sagian, 8 mi. N. of Lahore	<u>Bos indicus</u>	10♂, 7♀	"
C 1332	28 May 1964	"	Malakpur, 11 mi. SE of Lahore (Harike Rd.)	"	3♂, 3♀	"
C 1333B	28 May 1964	"	12 mi. SE of Lahore (Harike Rd.)	<u>Bubalus bubalis</u>	15♂, 8♀	"
C 1334A	28 May 1964	"	10 mi. SE of Lahore (Harike Rd.)	<u>Bos indicus</u>	3♂, 2♀	"
C 1335A	28 May 1964	"	Jandra, 10 mi. SE of Lahore (Harike Rd.)	<u>Bubalus bubalis</u>	12♂, 8♀	"
C 1336A	28 May 1964	"	Marri, 11 mi. SE of Lahore (Harike Rd.)	"	9♂, 1♀	"
C 1337A	28 May 1964	"	Malakpur, 11 mi. SE of Lahore (Harike Rd.)	"	6♂, 5♀	"
C 1338A	28 May 1964	"	"	<u>Bos indicus</u>	5♂, 5♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1344	11 Jun 1964	Lahore	Kotli, 10 mi. E. of Lahore (Wagah Rd.)	<u>Equus caballus</u>	2♀	Nazeer M. Khan
C 1345B	11 Jun 1964	"	Jallo, 13 mi. E. of Lahore (Wagah Rd.)	<u>Bos indicus</u>	16♂, 8♀	"
C 1346A	11 Jun 1964	"	Pathe, 17 mi. E. of Lahore (Amritsar R. W. L.)	<u>Bubalus bubalis</u>	33♂, 38♀	"
C 1347B	11 Jun 1964	"	"	<u>Bos indicus</u>	3♂, 7♀	"
C 1348A	14 Jul 1964	"	Tera, 8 mi. E. of Lahore	<u>Bubalus bubalis</u>	6♂	"
C 1349A	14 Jul 1964	"	"	<u>Ovis aries</u>	1♂, 2♀	"
C 1352A	16 Jul 1964	"	Jaman, 22 mi. SSE of Lahore	<u>Bos indicus</u>	2♂	"
C 1353A	16 Jul 1964	"	"	<u>Bubalus bubalis</u>	28♂, 6♀	"
C 1354A	16 Jul 1964	"	Barki, 17 mi. SE of Lahore (Harike Rd.)	"	8♂	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1355A	16 Jul 1964	Lahore	14 mi. SE of Lahore (Harike Rd.)	<u>Bubalus bubalis</u>	11♂, 9♀	Nazeer M. Khan
C 1356	17 Jul 1964	"	38 mi. SW of Lahore (Multan Rd.)	"	1♂, 1♀	"
C 1358B	18 Jul 1964	"	Bunga Mala, Balloki, Lahore Dist.	"	1♂	"
C 1359	18 Jul 1964	"	"	<u>Bos indicus</u>	9♂, 7♀	"
C 1360A	19 Jul 1964	"	Jagga, 8 mi. from Balloki H. W., on Lower Bari Doab Canal	<u>Bubalus bubalis</u>	1♂	"
C 1362B	19 Jul 1964	"	Balloki H. W.	"	2♂	"
C 1364A	19 Jul 1964	"	Khokhar, 3 mi. S. of Balloki H. W., Lahore	"	6♂, 7♀	"
C 1366A	27 Jul 1964	"	2 mi. N. of Lahore	<u>Bos indicus</u>	26♂, 15♀	"
C 1367A	27 Jul 1964	"	Karol, 3 mi. N. of Lahore	"	7♂, 6♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1368	27 Jul 1964	Lahore	Karol, 3 mi. N. of Lahore	<u>Canis aureus</u>	3♂	Nazeer M. Khan
C 1369A	28 Jul 1964	"	Pir Naseer, 8 mi. E. of Lahore	<u>Bos indicus</u>	33♂, 28♀	"
C 1370A	28 Jul 1964	"	"	<u>Bubalus bubalis</u>	4♂, 1♀	"
C 1371A	28 Jul 1964	"	11 mi. E. of Lahore	<u>Bos indicus</u>	20♂, 4♀	"
C 1372	28 Jul 1964	"	"	<u>Bubalus bubalis</u>	5♂, 6♀	"
C 1373A	28 Jul 1964	"	7 mi. E. of Lahore	"	8♂, 8♀	"
C 1374	28 Jul 1964	"	Fateh Garh, 5 mi. E. of Lahore	"	3♂, 2♀	"
C 1375A	30 Jul 1964	"	Duggra, 9 mi. E. of Lahore (Wagah Rd.)	<u>Capra hircus</u>	2♂, 2♀	"
C 1377A	30 Jul 1964	"	11 mi. SE of Lahore (Harike Rd.)	<u>Bubalus bubalis</u>	1♂	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1378	6 Aug 1964	Rawalpindi	Phagwari, 15 mi. NE of Murree, 4,457 ft.	<u>Bos indicus</u>	11♂, 13♀	Nazeer M. Khan
C 1379	9 Aug 1964	"	Upper Devil, 19 mi. from Murree on Upper Devil Rd., 6,000 ft.	"	10♂, 6♀	"
C 1386B	21 Aug 1964	Lahore	13 mi. SE of Lahore (Harike Rd.)	"	11♂	"
C 1388A	30 Jul 1964	"	Duggra, 9 mi. E. of Lahore (Wagah Rd.)	<u>Bubalus bubalis</u>	11♂, 3♀	"
C 1389	22 Aug 1964	"	Maniala, 18 mi. E. of Lahore	<u>Ovis aries</u>	4♂, 1♀	"
C 1393B	24 Aug 1964	"	Jallo area, 13 mi. E. of Lahore	"	1♂	"
C 1394A	24 Aug 1964	"	Jallo area, 13 mi. E. of Lahore	<u>Capra hircus</u>	4♂, 2♀	"
C 1395	24 Aug 1964	"	Jallo area, 13 mi. E. of Lahore	<u>Lepus nigricollis</u>	1♂, 1♀	"
C 1396	7 Feb 1964	Hyderabad	Umarkot, Thar Parkar Dist.	<u>Equus caballus</u>	3♂, 1♀	"

TABLE 20. Material examined and identified as Hyalomma anatolicum anatolicum Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1397A	24 Aug 1964	Lahore	Talwara, 18 mi. E. of Lahore	<u>Capra hircus</u>	9♂, 5♀	Nazeer M. Khan
C 1398	24 Aug 1964	"	Rat Garh, 10 mi. NNE of Lahore	"	3♂, 4♀	"
C 1399	24 Aug 1964	"	"	<u>Felis chaus</u>	1♂	"
C 1401A	24 Aug 1964	"	6 mi. N. of Lahore	<u>Capra hircus</u>	6♂, 1♀	"
C 1402	25 Aug 1964	"	8 mi. E. of Lahore	<u>Ovis aries</u>	4♂, 8♀	"
C 1403	25 Aug 1964	"	"	<u>Equus caballus</u>	1♀	"
C 1404	25 Aug 1964	"	Harbanspura Forest, 11 mi. E. of Lahore	<u>Canis aureus</u>	3♂	"
C 1407A	17 Sept 1964	"	Changa Manga Forest, Lahore Dist.	<u>Bos indicus</u>	3♂, 2♀	"
C 1416	15 Oct 1964	"	Changa Manga Forest, Lahore	Off ground	1♂	"

TABLE 21. Material examined and identified as Hyalomma anatolicum excavatum Koch, 1844.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 573D	17 Jun 1964	Quetta	Gulistan, 35 mi. NW of Quetta, 7,000 ft.	<u>Camelus dromedarius</u>	1♀	Traub Group
C 574B	13 Jun 1964	"	Hindubagh, Zhob Dist.	<u>Bos indicus</u>	5♂	"
C 575A	14 Jun 1964	"	"	<u>Ovis aries</u>	2♂, 3♀	"
C 588B	13 Jun 1964 14 Jun 1964	"	"	"	3♂, 1♀	"
C 844A	3 Apr 1964	Kalat	10 mi. E. of Turbat (Hoshab Rd.)	<u>Camelus dromedarius</u>	1♀	V. C. McCarthy and Z. B. Mirza



TABLE 22. Material examined and identified as Hyalomma asiaticum asiaticum Schulze and Schlottko, 1929. Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 132A	26 Mar 1963	Quetta	Ft. Sandeman, 4,500 ft.	Domestic animals (sheep, goats, cattle, camels, buffalo)	1♂	Dept. of Animal Husbandry (West Pakistan)
C 135C	26 Mar 1963	"	Ft. Sandeman, 4,500 ft.	"	1♂	"
C 148D	30 Mar 1963	"	Urrak, 14 mi. E. of Quetta, 6,994 ft.	<u>Ovis aries</u>	1♂	V. C. McCarthy and Z. B. Mirza
C 151B	30 Mar 1963	"	Hanna, 8 mi. E. of Quetta, 6,322 ft.	"	1♂	"
C 154B	31 Mar 1963	"	60 mi. NNW of Quetta	<u>Camelus dromedarius</u>	3♂, 2♀	"
C 155B	31 Mar 1963	"	5 mi. S. of Chaman on Baghrat Top Rd.	<u>Ovis aries</u>	2♂, 3♀	"
C 158A	2 Apr 1963	"	Chagai, 36 mi. NNE of Dalbandin	<u>Camelus dromedarius</u>	1♂	"
C 217B	7 Apr 1963	Kalat	77 mi. SSW of Kalat on Panjgur Rd.	<u>Hemiechinus megalotis</u>	1♂	"

TABLE 22. Material examined and identified as Hyalomma asiaticum asiaticum Schulze and Schlottke, 1929. Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 286	24 May 1963	Peshawar	3 mi. S. of Warsak, 12 mi. NW of Peshawar, 1,200 ft.	<u>Capra hircus</u>	4♂, 2♀	V. C. McCarthy and Z. B. Mirza
C 574C	13 Jun 1964	Quetta	Hindubagh, Zhob Dist.	<u>Bos indicus</u>	2♂	Traub Group
C 851	7 Apr 1964	Kalat	6 mi. SW of Kalat (on Surab Rd.)	Off ground	1♂, 1♀	V. C. McCarthy and Z. B. Mirza

TABLE 23. Material examined and identified as Hyalomma detritum Schulze, 1919.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 132B	26 Mar 1963	Quetta	Ft. Sandeman, 4, 500 ft.	Domestic animals (sheep, goats, cattle, camels, buffalo)	2♂	Dept of Animal Husbandry (West Pakistan)
C 163B	5 Apr 1963	Kalat	Borristan, 6 mi. S. of Panjgur on Turbat Rd.	<u>Bos indicus</u>	3♂	V. C. McCarthy and Z. B. Mirza
C 169C	5 Apr 1963	"	Vashbodth, 3 mi. NE of Panjgur on Kalat Rd.	"	3♂, 1♀	"
C 203A	10 Apr 1963	Quetta	11 mi. W. of Loralai on Ziarat Rd.	"	5♂, 8♀	"
C 208A	11 Apr 1963	"	14 mi. NW of Loralai on Kila Saif Ullah Rd.	"	1♂	"
C 222B	23 Apr 1963	Lahore	Balloki H. W., 40 mi. from Lahore	<u>Bubalus bubalis</u>	10♂, 1♀	Z. B. Mirza
C 223B	23 Apr 1963	"	"	<u>Bos indicus</u>	1♂	"
C 235B	3 May 1963	Bahawalpur	21 mi. SE of Bahawalpur	"	109♂, 47♀	V. C. McCarthy and Z. B. Mirza
C 236B	3 May 1963	"	"	<u>Bubalus bubalis</u>	49♂, 43♀	"

TABLE 23. Material examined and identified as Hyalomma detritum Schulze, 1919.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 237A	3 May 1963	Bahawalpur	21 mi. SE of Bahawalpur	<u>Camelus dromedarius</u>	5♂, 5♀	V. C. McCarthy and Z. B. Mirza
C 253	7 May 1963	Khairpur	Tajjal, Khairpur Dist.	<u>Bubalus bubalis</u>	5♂, 1♀	"
C 256B	10 May 1963	Karachi	Sonmiani Beach Area, 32 mi. W. of Karachi	"	1♂, 1♀	"
C 257B	10 May 1963	"	"	<u>Bos indicus</u>	2♂	"
C 268	14 May 1963	Khairpur	1 mi. from Gumbat Rest House on Rohri Canal, 15 mi. SW of Khairpur	"	4♂, 4♀	"
C 269	14 May 1963	"	"	<u>Bubalus bubalis</u>	2♂, 3♀	"
C 277	16 May 1963	Multan	9 mi. W. of Muzaffargarh on D. G. Khan Rd.	<u>Bos indicus</u>	3♂, 1♀	"
C 278	16 May 1963	"	13 mi. W. of Muzaffargarh on D. G. Khan Rd.	<u>Bubalus bubalis</u>	16♂, 7♀	"

TABLE 23. Material examined and identified as Hyalomma detritum Schulze, 1919.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 330	13 Jun 1963	Peshawar	Chilas	<u>Bos indicus</u>	6♂, 6♀	Z. B. Mirza
C 346A	18 Jul 1963	Multan	10 mi. E. of Taunsa Barrage (Ranjpur Rd.)	<u>Bubalus bubalis</u>	2♂, 2♀	"
C 347	18 Jul 1963	"	"	Off ground	4♀	"
C 349	19 Jul 1963	"	15 mi. E. of Taunsa Barrage (Ranjpur Rd.)	"	1♂	"
C 355B	20 Jul 1963	Quetta	Kingri, 83 mi. E. of Loralai	<u>Capra hircus</u>	1♂	"
C 356B	20 Jul 1963	"	"	<u>Bos indicus</u>	1♂, 3♀	"
C 357A	20 Jul 1963	"	"	<u>Equus caballus</u>	7♂, 12♀	"
C 391B	1 Aug 1963	Kalat	Surab	<u>Bos indicus</u>	3♂	"
C 392B	1 Aug 1963	"	Surab	<u>Camelus dromedarius</u>	1♂	"
C 393	1 Aug 1963	"	8 mi. N. of Surab	<u>Bos indicus</u>	17♂, 4♀	"
C 396A	2 Aug 1963	"	45 mi. N. of Bela on Khuzdar Rd.	Off ground	1♀	"

TABLE 23. Material examined and identified as Hyalomma detritum Schulze, 1919.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 397B	4 Aug 1963	Karachi	Bela	<u>Camelus dromedarius</u>	5♂, 5♀	Z. B. Mirza
C 398D	4 Aug 1963	"	"	<u>Bos indicus</u>	3♂, 4♀	"
C 417B	12 Aug 1963	Khairpur	Ubauro, 70 mi. NE of Sukkur	<u>Bubalus bubalis</u>	1♂	"
C 418B	12 Aug 1963	"	Ubauro, 70 mi. NE of Sukkur	<u>Bos indicus</u>	1♂	"
C 419B	13 Aug 1963	Bahawalpur	6 mi. S. of Bahawalpur (on Yazman Rd.)	<u>Camelus dromedarius</u>	2♂	"
C 420	13 Aug 1963	"	"	<u>Bos indicus</u>	1♀	"
C 444B	14 Aug 1963	"	10 mi. E. of Islam H. W.	<u>Bubalus bubalis</u>	15♂, 1♀	"
C 465B	18 Sept 1963	Peshawar	Mansehra, Hazara Dist.	"	1♂	V. C. McCarthy and Z. B. Mirza
C 486A	25 Sept 1963	Rawalpindi	18 mi. NW of Rawalpindi on Taxilla Rd.	<u>Bos indicus</u>	1♂	"
C 597B	13 Aug 1964	Peshawar	Amandara, Malakand Agency, 3,750 ft.	<u>Camelus dromedarius</u>	1♂, 1♀	Traub Group

TABLE 23. Material examined and identified as Hyalomma detritum Schulze, 1919.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 840	31 Mar 1964	Kalat	Diz, 60 mi. SW of Panjgur	<u>Bos indicus</u>	1♂	V. C. McCarthy and Z. B. Mirza
C 847	3 Apr 1964	"	Hoshab	<u>Capra hircus</u>	2♀	"
C 864A	27 Jun 1964	Rawalpindi	Panjar, Rawalpindi Dist., on Azad Pattan Rd., 2,753 ft.	<u>Bos indicus</u>	1♂	Z. B. Mirza and Nazeer M. Khan
C 875B	13 Jul 1964	Lahore	Bajwat, Sialkot Dist.	<u>Bubalus bubalis</u>	3♂, 2♀	Z. B. Mirza
C 877A	13 Jul 1964	"	"	<u>Capra hircus</u>	1♂	"
C 895	5 Jun 1964	"	Balloki H. W., Lahore Dist.	<u>Bubalus bubalis</u>	16♂, 18♀	Z. B. Mirza and Nazeer M. Khan
C 904B	1963	Sargodha	Shahpur, Mianwali Dist.	"	3♂	Dept. of Animal Husbandry (West Pakistan)
C 907B	24 Aug 1963	Khairpur	Ubauro, Sukkur Dist.	"	3♂	Dept. of Animal Husbandry (West Pakistan)

TABLE 23. Material examined and identified as Hyalomma detritum Schulze, 1919.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 915B	22 Jul 1963	Rawalpindi	Pind Dadan Khan, Jhelum Dist. (W. Bank)	<u>Bubalus bubalis</u>	1♂, 1♀	Dept. of Animal Husbandry (West Pakistan)
C 918B	28 Aug 1963	Karachi	Hab Chowki, near Hab River on Bela Rd.	<u>Bos indicus</u>	4♂	"
C 919B	23 May 1963	Sargodha	Mianwali	<u>Bubalus bubalis</u>	16♂, 10♀	"
C 948B	8 Jun 1963	"	"	<u>Camelus dromedarius</u>	1♂	"
C 950B	7 Jun 1963	"	"	<u>Bos indicus</u>	3♂, 1♀	"
C 977B	2 May 1963	Lahore	Lahore Dist.	<u>Bubalus bubalis</u> and <u>Bos indicus</u>		
C 1303A	28 Apr 1964	"	Balloki H. W., Lahore	<u>Bubalus bubalis</u>	9♂	Nazeer M. Khan
C 1307B	29 Apr 1964	"	"	"	1♂	"
C 1308B	29 Apr 1964	"	Aulakh, Balloki H. W. Area, Lahore Dist.	"	2♀	"



TABLE 23. Material examined and identified as Hyalomma detritum Schulze, 1919.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1311B	8 May 1964	Lahore	17 mi. E. of Lahore (Wagah Rd.)	<u>Bubalus bubalis</u>	1♂	Nazeer M. Khan
C 1323B	25 May 1964	"	11 mi. NE of Lahore	"	4♂, 1♀	"
C 1330B	26 May 1964	"	12 mi. NE of Lahore	"	6♂, 4♀	"
C 1335B	28 May 1964	"	Jandra, 10 mi. SE of Lahore (Harike Rd.)	"	2♂	"
C 1336B	28 May 1964	"	Marri, 11 mi. SE of Lahore (Harike Rd.)	"	1♂	"
C 1337B	28 May 1964	"	Malakpur, 11 mi. SE of Lahore (Harike Rd.)	"	2♀	"
C 1338B	28 May 1964	"	"	<u>Bos indicus</u>	1♂	"
C 1358A	18 Jul 1964	"	Bunga Mala, Balloki, Lahore Dist.	<u>Bubalus bubalis</u>	15♂	"
C 1360B	19 Jul 1964	"	Jagga, 8 mi. from Balloki H. W. on Lower Bari Doab Canal	"	12♂, 6♀	"
C 1361A	19 Jul 1964	"	Balloki H. W., Lahore	<u>Camelus dromedarius</u>	4♂, 1♀	"

TABLE 23. Material examined and identified as Hyalomma detritum Schulze, 1919.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1362A	19 Jul 1964	Lahore	Balloki H. W.	<u>Bubalus</u> <u>bubalis</u>	10♂, 5♀	Nazeer M. Khan
C 1363A	19 Jul 1964	"	Maliwal, 4 mi. N. of Balloki H. W.	<u>Camelus</u> <u>dromedarius</u>	3♂, 1♀	"
C 1377B	30 Jul 1964	"	11 mi. SE of Lahore (Harike Rd.)	<u>Bubalus</u> <u>bubalis</u>	1♂	"
C 1388B	30 Jul 1964	"	Duggra, 9 mi. E. of Lahore (Wagah Rd.)	"	1♂	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 2B	24 Aug 1962	Lahore	Kahna Kacha, 18 mi. S. of Lahore	<u>Bos indicus</u>	1♂	V. C. McCarthy
C 4B	6 Sept 1962	"	Shahzada, 19 mi. S. of Lahore	<u>Bubalus bubalis</u>	1♂	"
C 5B	6 Sept 1962	"	"	<u>Bubalus bubalis</u>	6♂	"
C 6	6 Sept 1962	"	"	<u>Bos indicus</u>	1♀	"
C 8B	17 Sept 1962	"	"	<u>Bos indicus</u>	14♂, 4♀	"
C 12B	19 Sept 1962	"	Sheikhupura City	<u>Bubalus bubalis</u>	1♂	"
C 25B	21 Nov 1962	"	Kot Abdul Malik, Dist. Sheikhupura	<u>Camelus dromedarius</u>	8♂, 5♀	Z. B. Mirza
C 26A	21 Nov 1962	"	"	<u>Bos indicus</u>	1♂	"
C 28B	25 Jan 1963	Multan	Haveli, 12 mi. NW of Sulemanki H. W.	<u>Camelus dromedarius</u>	16♂, 4♀	V. C. McCarthy and Z. B. Mirza
C 31	27 Jan 1963	Bahawalpur	Janu Wali, 20 mi. SSE of Yazman	<u>Camelus dromedarius</u>	4♂, 18♀	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 33	27 Jan 1963	Bahawalpur	Janu Wali, 20 mi. SSE of Yazman	<u>Bos indicus</u>	3♂	V. C. McCarthy and Z. B. Mirza
C 36	28 Jan 1963	"	Dera Nawab Sahib	<u>Camelus dromedarius</u>	12♂, 3♀	"
C 37A	28 Jan 1963	"	Ft. Derawar	"	4♂, 3♀	"
C 38B	28 Jan 1963	"	"	<u>Bos indicus</u>	2♂, 6♀	"
C 40A	29 Jan 1963	"	Ahmadpur East	"	1♂	"
C 41A	29 Jan 1963	"	"	<u>Camelus dromedarius</u>	9♂, 1♀	"
C 43B	29 Jan 1963	"	"	<u>Ovis aries</u>	1♂	"
C 44A	29 Jan 1963	"	"	<u>Bubalus bubalis</u>	2♂, 1♀	"
C 61	4 Feb 1963	Hyderabad	Nagar Parkar	<u>Camelus dromedarius</u>	2♂, 5♀	"
C 62A	4 Feb 1963	"	Nagar Parkar	"	5♂, 7♀	"
C 64	4 Feb 1963	"	"	<u>Equus caballus</u>	13♂, 4♀	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 66B	4 Feb 1963	Hyderabad	Nagar Parkar	<u>Bos indicus</u>	2♂, 2♀	V. C. McCarthy and Z. B. Mirza
C 68C	5 Feb 1963	"	Pithapur, on Salt Flats near Nagar Parkar	<u>Gazella gazella bennetti</u>	1♂	"
C 79B	17 Feb 1963	Khairpur	8 mi. NW of Jacobabad on Quetta Rd.	<u>Bubalus bubalis</u>	3♂, 3♀	"
C 83	19 Feb 1963	Multan	Muzaffargarh (W. Bank Chenab River)	"	2♀	"
C 84	19 Feb 1963	"	Muzaffargarh (E. Bank Chenab River)	<u>Camelus dromedarius</u>	1♀	"
C 86	6 Mar 1963	Lahore	Attari Saroba, 11 mi. S. of Lahore	<u>Bubalus bubalis</u>	3♂	"
C 87B	6 Mar 1963	"	"	<u>Bos indicus</u>	1♂, 3♀	"
C 90B	6 Mar 1963	"	"	<u>Camelus dromedarius</u>	1♂, 4♀	"
C 96B	13 Mar 1963	"	Lalu Khichi (Balloki H. W.) 40 mi. from Lahore	<u>Bubalus bubalis</u>	1♀	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 99B	14 Mar 1963	Lahore	Bharoke, 25 mi. from Lahore on Gujranwala Rd.	<u>Bos indicus</u>	4♂	V. C. McCarthy and Z. B. Mirza
C 101B	14 Mar 1963	"	Manhase, 25 mi. N. of Lahore on Gujranwala Rd.	<u>Bubalus bubalis</u>	2♀	"
C 111B	20 Mar 1963	D. I. Khan	Kalabagh	<u>Camelus dromedarius</u>	3♂, 3♀	"
C 114B	21 Mar 1963	"	Khuda Zai, 9 mi. SW of Kalabagh on Banu Rd.	"	1♀	"
C 118B	23 Mar 1963	"	D. I. Khan City	<u>Capra hircus</u>	1♂, 1♀	"
C 119B	23 Mar 1963	"	"	<u>Bubalus bubalis</u>	2♀	"
C 120A	23 Mar 1963	"	Pusha, 8 mi. from D. I. Khan on Banu Rd.	<u>Camelus dromedarius</u>	1♂	"
C 125B	24 Mar 1963	"	5 mi. W. of D. I. Khan on Paharpur Canal	<u>Ovis aries</u>	1♂	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 132D	26 Mar 1963	Quetta	Ft. Sandeman 4,500 ft.	Misc. domestic animals	13♂, 1♀	Dept of Animal Husbandry (West Pakistan)
C 135D	26 Mar 1963	"	"	"	3♂, 3♀	"
C 143B	29 Mar 1963	"	Quetta City	<u>Camelus dromedarius</u>	3♂, 8♀	V. C. McCarthy and Z. B. Mirza
C 154C	31 Mar 1963	"	60 mi. NNW of Quetta	"	1♂	"
C 156A	31 Mar 1963	"	Gul Mohammad, 8 mi. S. of Chaman on Baghrat Top Rd.	"	2♀	"
C 157A	2 Apr 1963	"	Dalbandin	"	8♂, 2♀	"
C 158B	2 Apr 1963	"	Chagai, 36 mi. NNE of Dalbandin	"	8♂, 4♀	"
C 160A	2 Apr 1963	"	7 mi. from Dalbandin on Nushki Rd.	"	2♂	"
C 161	2 Apr 1963	"	16 mi. from Dalbandin on Nok Kundi Rd.	"	9♂, 8♀	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 162B	5 Apr 1963	Kalat	Irrai, 4 mi. S. of Panjgur on Turbat Rd.	<u>Ovis aries</u>	1♀	V. C. McCarthy and Z. B. Mirza
C 163C	5 Apr 1963	"	Borristan, 6 mi. S. of Panjgur on Turbat Rd.	<u>Bos indicus</u>	21♂, 11♀	"
C 166A	5 Apr 1963	"	Vashbodth, 3 mi. NE of Panjgur on Kalat Rd.	<u>Camelus dromedarius</u>	1♂, 1♀	"
C 169B	5 Apr 1963	"	"	<u>Bos indicus</u>	1♂	"
C 213A	13 Apr 1963	Multan	Taunsa Barrage	<u>Camelus dromedarius</u>	4♂, 2♀	"
C 215B	13 Apr 1963	"	14 mi. E. of Taunsa Barrage on Rangpur Rd.	"	3♂, 1♀	"
C 222C	23 Apr 1963	Lahore	Balloki H. W., 40 mi. from Lahore	<u>Bubalus bubalis</u>	1♂, 1♀	Z. B. Mirza
C 223C	23 Apr 1963	"	"	<u>Bos indicus</u>	4♂	"
C 231B	2 May 1963	Bahawalpur	Lal Sohara-22 mi. E. of Bahawalpur	<u>Ovis aries</u>	1♀	V. C. McCarthy and Z. B. Mirza
C 233A	2 May 1963	"	9 mi. NE of Bahawalpur on Bahawalpur Rd.	<u>Camelus dromedarius</u>	19♂	"



TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection		Date	Administrative		Locality	Host	Specimens	Collector
No.			Division					
C 235C		3 May 1963	Bahawalpur		21 mi. SE of Bahawalpur	<u>Bos indicus</u>	16♂, 10♀	V. C. McCarthy and Z. B. Mirza
C 236C		3 May 1963	"		"	<u>Bubalus bubalis</u>	14♂, 16♀	"
C 237B		3 May 1963	"		"	<u>Camelus dromedarius</u>	74♂, 40♀	"
C 238B		3 May 1963	"		"	<u>Capra hircus</u>	15♂, 23♀	"
C 245B		5 May 1963	"		10 mi. S. of Dera Nawab Sahib	<u>Camelus dromedarius</u>	18♂, 7♀	"
C 256C		10 May 1963	Karachi		Sonmiani Beach Area, 32 mi. W. of Karachi	<u>Bubalus bubalis</u>	1♀	"
C 258		10 May 1963	"		24 mi. W. of Karachi	<u>Camelus dromedarius</u>	4♂, 6♀	"
C 259C		10 May 1963	"		Hub, 11 mi. W. of Karachi	<u>Bos indicus</u>	1♂, 3♀	"
C 263B		11 May 1963	"		14 mi. ENE of Karachi on Thano Bula Khan Rd.	"	5♂, 1♀	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 265A	12 May 1963	Hyderabad	Buhara, 62 mi. ESE of Karachi	<u>Bubalus bubalis</u>	1♀	V. C. McCarthy and Z. B. Mirza
C 285C	24 May 1963	Peshawar	3 mi. W. of Peshawar on Warsak Rd.	<u>Bos indicus</u>	1♂, 1♀	"
C 341	18 Jul 1963	Multan	Taunsa Barrage, West Side	<u>Camelus dromedarius</u>	16♂, 6♀	Z. B. Mirza
C 343C	18 Jul 1963	"	"	<u>Bos indicus</u>	4♂, 2♀	"
C 346B	18 Jul 1963	"	10 mi. E. of Taunsa Barrage (Ranjpur Rd.)	<u>Bubalus bubalis</u>	9♂, 8♀	"
C 357B	20 Jul 1963	Quetta	Kingri, 83 mi. E. of Loralai	<u>Equus caballus</u>	2♂, 1♀	"
C 374A	26 Jul 1963	"	Gulistan, 45 mi. NNW of Quetta	<u>Camelus dromedarius</u>	29♂, 14♀	"
C 375B	26 Jul 1963	"	5 mi. S. of Gulistan, 40 mi. NNW of Quetta	<u>Ovis aries</u>	1♂	"
C 376	26 Jul 1963	"	Qila Abdullah, 40 mi. N. of Quetta	<u>Camelus dromedarius</u>	7♂, 6♀	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 382B	29 Jul 1963	Quetta	Nushki	<u>Bos indicus</u>	2♂, 2♀	Z. B. Mirza
C 384A	30 Jul 1963	"	2 mi. N. of Nushki	<u>Camelus dromedarius</u>	13♂, 1♀	"
C 386A	30 Jul 1963	"	"	<u>Bos indicus</u>	1♂	"
C 391C	1 Aug 1963	Kalat	Surab	"	4♂	"
C 392C	1 Aug 1963	"	"	<u>Camelus dromedarius</u>	11♂, 8♀	"
C 393B	1 Aug 1963	"	8 mi. N. of Surab	<u>Bos indicus</u>	2♂	"
C 396B	2 Aug 1963	"	45 mi. N. of Bela on Khuzdar Rd.	Off ground	1♂	"
C 397C	4 Aug 1963	Karachi	Bela	<u>Camelus dromedarius</u>	4♂, 11♀	"
C 398E	4 Aug 1963	"	"	<u>Bos indicus</u>	11♂, 8♀	"
C 399B	4 Aug 1963	"	"	<u>Ovis aries</u>	1♀	"
C 406B	8 Aug 1963	"	Hawks Bay	"	3♂, 1♀	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 409B	10 Aug 1963	Khairpur	Nawabshah	<u>Ovis aries</u>	2♂, 1♀	Z. B. Mirza
C 410B	10 Aug 1963	"	"	<u>Camelus dromedarius</u>	21♂, 13♀	"
C 415B	11 Aug 1963	"	Ubauro, 70 mi. NE of Sukkur	<u>Ovis aries</u>	4♂, 1♀	"
C 417C	12 Aug 1963	"	"	<u>Bubalus bubalis</u>	3♂, 1♀	"
C 418C	12 Aug 1963	"	"	<u>Bos indicus</u>	1♂	"
C 419C	13 Aug 1963	Bahawalpur	6 mi. S. of Bahawalpur (on Yazman Rd.)	<u>Camelus dromedarius</u>	7♂, 2♀	"
C 423B	13 Aug 1963	"	"	<u>Bubalus bubalis</u>	3♂, 2♀	"
C 424B	13 Aug 1963	"	Bahawalpur	<u>Equus caballus</u>	3♂	"
C 426B	13 Aug 1963	"	Islam H. W., Bahawalpur	<u>Bubalus bubalis</u>	1♂	"
C 444C	14 Aug 1963	"	10 mi. E. of Islam H. W., Bahawalpur	"	7♂, 2♀	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 448B	14 Aug 1963	Multan	20 mi. NW of Islam H. W., Bahawalpur	<u>Ovis aries</u>	1♂	Z. B. Mirza
C 449B	14 Aug 1963	"	"	<u>Camelus dromedarius</u>	11♂, 2♀	"
C 483C	24 Sept 1963	Rawalpindi	13 mi. W. of Rawalpindi	<u>Bos indicus</u>	1♀	V. C. McCarthy and Z. B. Mirza
C 513A	1 Nov 1963	Quetta	Nushki	<u>Camelus dromedarius</u>	39♂, 13♀	"
C 516	3 Nov 1963	"	5 mi. W. of Sibi (Quetta Rd.)	Off ground	1♂	"
C 517	3 Nov 1963	"	8 mi. W. of Sibi (Quetta Rd.)	<u>Camelus dromedarius</u>	25♂, 15♀	"
C 521	8 Nov 1963	Karachi	30 mi. NW of Karachi, (Bela Rd.)	<u>Bos indicus</u>	7♂	"
C 529C	24 Apr 1964	Peshawar	Shangla, Swat State	<u>Bos indicus</u>	2♂	Traub Group
C 573A	17 Jun 1964	Quetta	Gulistan, 35 mi. NW of Quetta, 7,000 ft.	<u>Camelus dromedarius</u>	66♂, 41♀	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 586	16 Jun 1964	Quetta	Gulistan, Pashin Dist.	<u>Camelus dromedarius</u>	2♂, 1♀	Traub Group
C 597C	13 Aug 1964	Peshawar	Amandara, Malakand Agency, 3,750 ft.	"	8♂, 1♀	"
C 654B	18 Apr 1964	Bahawalpur	Ft. Abbas, Bahawalpur Dist.	<u>Bos indicus</u>	1♂	"
C 666B	1 Feb 1964	D. I. Khan	D. I. Khan Area	"	6♂, 1♀	"
C 683	3 Oct 1964	Lahore	Charwa, Sialkot Dist.	"	1♀	"
C 687	4 Oct 1964	"	"	"	1♀	"
C 704	4 Oct 1964	"	"	"	1♂, 3♀	"
C 714B	3 Oct 1964	"	"	<u>Bubalus bubalis</u>	2♂	"
C 785B	9 Nov 1963	Karachi	16 mi. NE of Karachi on T. B. Khan Rd.	<u>Camelus dromedarius</u>	8♂, 5♀	V. C. McCarthy and Z. B. Mirza
C 793B	13 Nov 1963	Hyderabad	8 mi. W. of Tatta (on Karachi Rd.)	"	1♂	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 794	13 Nov 1963	Hyderabad	14 mi. W. of Tatta (on Karachi Rd.)	<u>Camelus dromedarius</u>	8♂, 3♀	V. C. McCarthy and Z. B. Mirza
C 796C	13 Nov 1963	"	6 mi. NE of Tatta (Hyderabad Rd.)	<u>Bos indicus</u>	1♀	"
C 798B	16 Nov 1963	Multan	Shahwali, 10 mi. N. of Kashmor on D. G. Khan Rd.	"	3♂, 2♀	"
C 799	16 Nov 1963	"	16 mi. N. of Kashmor on D. G. Khan Rd.	<u>Camelus dromedarius</u>	3♂, 1♀	"
C 800	16 Nov 1963	"	20 mi. N. of Kashmor on D. G. Khan Rd.	<u>Capra hircus</u>	1♂	"
C 812	4 Feb 1964	Hyderabad	2 mi. S. of Nagar Parkar	<u>Camelus dromedarius</u>	2♂, 2♀	"
C 814B	7 Feb 1964	"	Nagar Parkar	<u>Bos indicus</u>	4♂, 1♀	"
C 823	19 Mar 1964	"	20 mi. E. of Taunsa Barrage (Ranjpur Rd.)	<u>Camelus dromedarius</u>	4♂, 1♀	"
C 835	28 Mar 1964	Kalat	10 mi. S. of Mastung (on Kalat Rd.)	"	2♂, 5♀	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 837B	29 Mar 1964	Kalat	5 mi. S. of Mastung (on Kalat Rd.)	<u>Bos indicus</u>	1♀	V. C. McCarthy and Z. B. Mirza
C 838	29 Mar 1964	"	"	<u>Camelus dromedarius</u>	8♀	"
C 839	31 Mar 1964	"	Diz, 60 mi. SW of Panjgur	Off ground	1♀	"
C 842C	1 Apr 1964	"	2 mi. E. of Pangjur (on Kalat Rd.)	<u>Capra hircus</u>	1♂	"
C 844B	3 Apr 1964	"	10 mi. E. of Turbat (Hoshab Rd.)	<u>Camelus dromedarius</u>	17♂, 10♀	"
C 845B	3 Apr 1964	"	Hoshab	<u>Bos indicus</u>	1♂, 1♀	"
C 849A	6 Apr 1964	"	5 mi. S. of Surab (on Khuzdar Rd.)	<u>Camelus dromedarius</u>	1♂	"
C 852B	9 Apr 1964	Quetta	10 mi. N. of Rakhni (on Kingri Rd.)	<u>Ovis aries</u>	1♀	"
C 856A	3 Apr 1964	Kalat	Hoshab	<u>Camelus dromedarius</u>	8♂, 8♀	"



TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 897B	16 Oct 1963	Karachi	Hab Chowki, near Karachi on Hab River Las Bela (Bela) Rd.	<u>Capra hircus</u>	1♀	Dept of Animal Husbandry (West Pakistan)
C 901B	19 Aug 1963	Hyderabad	Matli, Hyderabad Dist.	<u>Camelus dromedarius</u>	1♂, 1♀	"
C 903B	14 Apr 1963	Rawalpindi	Rajajang, Dist. Rawalpindi	<u>Bos indicus</u>	15♂, 15♀	"
C 904C	1963	Sargodha	Shahpur, Mianwali Dist.	<u>Bubalus bubalus</u>	3♂	"
C 907C	24 Aug 1963	Khairpur	Ubauro, Sukkur Dist.	"	1♂	"
C 908B	22 Apr 1963	Lahore	Kasur, Lahore Dist.	<u>Bos indicus</u>	3♂, 3♀	"
C 909B	8 Jun 1963	"	Gujranwala, 42 mi. N. of Lahore	<u>Capra hircus</u>	17♂, 5♀	"
C 911B	22 Apr 1963	"	Kasur, Lahore Dist.	<u>Bubalus bubalis</u>	3♂, 1♀	"
C 912B	1963	"	Akalgarh, Gujranwala Dist.	Poultry (?? - probably from poultry yard)	1♂	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 913B	6 Jun 1963	Lahore	Gujranwala	<u>Bos indicus</u>	7♂, 3♀	Dept. of Animal Husbandry (West Pakistan)
C 915C	22 Jul 1963	Rawalpindi	Pind Dadan Khan, Jhelum Dist. (W. Bank)	<u>Bubalus bubalis</u>	1♂	"
C 918C	28 Aug 1963	Karachi	Hab Chowki, near Hab River on Bela Rd.	<u>Bos indicus</u>	30♂, 13♀	"
C 920C	25 May 1963	Sargodha	Mianwali	<u>Camelus dromedarius</u>	1♂, 2♀	"
C 926	25 Sept 1963	Hyderabad	Tando Ghulam Ali, Hyderabad Dist.	<u>Bos indicus</u>	2♂, 1♀	"
C 930B	31 Aug 1963	Karachi	Karachi	"	1♀	"
C 935A	18 Sept 1963	Hyderabad	Nagar Parkar, Thar Parkar Dist.	"	1♂, 1♀	"
C 939B	17 Oct 1963	Karachi	Hab Chowki, (Hab River near Karachi on Bela Rd.)	<u>Ovis aries</u>	2♂	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 940A	28 Aug 1963	Karachi	Hab Chowki (Hab River near Karachi on Bela Rd.)	<u>Camelus dromedarius</u>	33♂, 2♀	Dept. of Animal Husbandry (West Pakistan)
C 944B	24 Aug 1963	Khairpur	Ubauro, Sukkur Dist.	<u>Bos indicus</u>	3♂, 1♀	"
C 947B	20 Aug 1963	Karachi	Uthal, Las Bela Dist.	<u>Camelus dromedarius</u>	44♂, 12♀	"
C 948C	8 Jun 1963	Sargodha	Mianwali, Sargodha Dist.	"	52♂, 31♀	"
C 950C	7 Jun 1963	"	"	<u>Bos indicus</u>	2♂, 1♀	"
C 954B	5 May 1963	"	"	"	1♂	"
C 957B	19 Aug 1963	Hyderabad	Matli, Hyderabad Dist.	"	1♂, 2♀	"
C 963	16 May 1963	Lahore	Wazirabad	<u>Bubalus bubalis</u>	2♂, 8♀	"
C 964B	21 Jul 1963	Rawalpindi	Pind Dadan Khan, Jhelum Dist.	<u>Camelus dromedarius</u>	8♂, 1♀	"
C 969B	20 Aug 1963	Karachi	Uthal, Las Bela Dist.	<u>Bos indicus</u>	12♂, 5♀	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 971C	27 May 1963	Rawalpindi	Chakwal, Jhelum Dist.	<u>Bos indicus</u>	4♂, 3♀	Dept. of Animal Husbandry (West Pakistan)
C 974	18 Sept 1963	Hyderabad	Mirpur Khas, Thar Parkar Dist.	<u>Camelus dromedarius</u>	4♂	"
C 979B	19 Aug 1963	Lahore	Tajpura, 8 mi. SE of Lahore (Harike Rd.)	<u>Bubalus bubalis</u>	1♂, 7♀	Nazeer M. Khan
C 980B	19 Aug 1963	"	Pir Naseer (1 mi. from Harbanspura, 8 mi. E. of Lahore on Canal)	"	3♂, 7♀	"
C 985B	20 Aug 1963	"	Paddri, 8 mi. SE of Lahore on Harike Rd.	"	10♂, 5♀	"
C 987B	20 Aug 1963	"	"	"	2♂, 5♀	"
C 989B	21 Aug 1963	"	Korian, 14 mi. SE of Lahore (on Harike Rd.)	"	2♂	"
C 992B	22 Aug 1963	"	Harbanspura Forest, 8 mi. E. of Lahore	<u>Vulpes bengalensis</u>	1♀	"
C 996B	29 Aug 1963	"	Balloki, 40 mi. SW of Lahore	<u>Bubalus bubalis</u>	1♂, 1♀	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 997B	29 Aug 1963	Lahore	Thata Khokhar, near Balloki, Lahore Dist	<u>Bubalus bubalis</u>	1♀	Nazeer M. Khan
C 1002A	30 Aug 1963	"	Attari, 8 mi. SW. of Balloki, Lahore Dist.	<u>Sus scrofa cristatus</u>	1♀	"
C 1004B	30 Aug 1963	"	"	<u>Bos indicus</u>	1♂	"
C 1007A	6 Sept 1963	"	10 mi. above Main Bridge on Ravi, Lahore Dist.	<u>Bubalus bubalis</u>	1♂	"
C 1019B	9 Sept 1963	"	Lakhanke, 16 mi. E. of Lahore on Wagah Rd.	"	2♂, 2♀	"
C 1020B	9 Sept 1963	"	Dial, 18 mi. E. of Lahore, on Wagah Rd.	"	4♂, 1♀	"
C 1021B	10 Sept 1963	"	Wagah, 19 mi. E. of Lahore (on Amritsar Border)	"	2♂	"
C 1022B	10 Sept 1963	"	"	<u>Bos indicus</u>	7♂	"
C 1023B	10 Sept 1963	"	Pathe, 14 mi. E. of Lahore, on Amritsar RWL	<u>Bubalus bubalis</u>	1♀	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1024B	11 Sept 1963	Lahore	17 mi. SE of Lahore (Harike Rd.)	<u>Bos indicus</u>	11♂, 4♀	Nazeer M. Khan
C 1025B	11 Sept 1963	"	Santpura, 20 mi. SE of Lahore (Harike Rd.)	"	14♂, 1♀	"
C 1026B	11 Sept 1963	"	Karbath, 17 mi. SE of Lahore (Harike Rd. near Barki)	"	2♂, 3♀	"
C 1027B	11 Sept 1963	"	Hare, 17 mi. SE of Lahore (Harike Rd. Area)	"	9♂, 2♀	"
C 1028B	12 Sept 1963	"	Wara Shadi, 17 mi. SE of Lahore (Harike Rd. Area)	<u>Bubalus bubalis</u>	8♂	"
C 1029B	12 Sept 1963	"	Nurpur, 17 mi. SE of Lahore (Harike Rd. Area)	"	6♂	"
C 1030B	12 Sept 1963	"	Barki, 20 mi. SE of Lahore (Harike Rd.)	"	2♂, 1♀	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1031B	13 Sept 1963	Lahore	Attari Saroba, 12 mi. SSE of Lahore (Ferozepur Rd.)	<u>Bubalus</u> <u>bubalis</u>	1♀	Nazeer M. Khan
C 1032B	13 Sept 1963	"	Jaade, 15 mi. SSE of Lahore (Ferozepur Rd.)	"	1♂	"
C 1033B	13 Sept 1963	"	Kulleki, 13 mi. SSE of Lahore (Ferozepur Rd.)	"	10♂, 9♀	"
C 1034B	13 Sept 1963	"	Shahzada, 13 mi. SSE of Lahore (Ferozepur Rd.)	"	11♂, 13♀	"
C 1036B	13 Sept 1963	"	Jhoka, 19 mi. SSE of Lahore (Ferozepur Rd.)	"	11♂, 5♀	"
C 1038B	13 Sept 1963	"	Khana Nao, 13 mi. SSE of Lahore (on Ferozepur Rd.)	"	2♀	"
C 1039B	13 Sept 1963	"	Bajn Matta, 11 mi. SSE of Lahore (Ferozepur Rd.)	"	2♀	"
C 1040B	13 Sept 1963	"	Kodde, 5 mi. S. of Lahore Cantt.	"	1♂	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1041B	14 Sept 1963	Lahore	Bahaddarpura, 12 mi. SW of Kasur, (Chunian Rd.) Lahore Dist.	<u>Bubalus bubalis</u>	4♂, 2♀	Nazeer M. Khan
C 1043B	14 Sept 1963	"	Dhollan, 20 mi. SW of Kasur (Chunian Rd.) Lahore Dist.	<u>Bos indicus</u>	1♂	"
C 1044B	14 Sept 1963	"	Bakkarke, 19 mi. SW of Kasur, 4 mi. from Border	<u>Bubalus bubalis</u>	3♂, 1♀	"
C 1045B	15 Sept 1963	"	Gandian, 19 mi SW of Kasur	<u>Bubalus bubalis</u>	3♂	"
C 1046B	15 Sept 1963	"	Kasur, 34 mi. SSE of Lahore (Ferozepur Rd.)	"	5♂	"
C 1047B	16 Sept 1963	"	Aasil, 26 mi. S. of Lahore (Ferozepur Rd.)	"	4♂, 2♀	"
C 1049B	17 Sept 1963	"	Changa Manga Forest, 40 mi. SSW of Lahore	<u>Equus caballus</u>	1♀	"
C 1053B	21 Sept 1963	"	Balloki H. W., 40 mi. SW of Lahore	<u>Bubalus bubalis</u>	1♀	"



TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1054B	24 Sept 1963	Lahore	Ferozewala, 6 mi. N. of Lahore (Gujranwala Rd.)	<u>Bubalus bubalis</u>	1♂	Nazeer M. Khan
C 1061B	26 Sept 1963	"	Khaki, 16 mi. NW of Lahore (Lyallpur Rd.)	<u>Bos indicus</u>	8♂, 16♀	"
C 1062	26 Sept 1963	"	Saijuwal, 21 mi. NW of Lahore (Lyallpur Rd.)	"	4♂, 3♀	"
C 1063B	26 Sept 1963	"	Budhoke, 10 mi. NW of Lahore (Lyallpur Rd.)	<u>Bubalus bubalis</u>	2♂, 2♀	"
C 1067B	16 Oct 1963	"	Talwara, 15 mi. E. of Lahore (Wagah Rd.)	"	1♂	"
C 1068B	16 Oct 1963	"	"	<u>Bos indicus</u>	1♀	"
C 1069B	17 Oct 1963	"	Marlmari, 10 mi. E. of Lahore (Wagah Rd.)	<u>Bubalus bubalis</u>	3♂	"
C 1070B	17 Oct 1963	"	"	<u>Bos indicus</u>	1♂	"
C 1073B	17 Oct 1963	"	Manawan, 12 mi. E. of Lahore (Wagah Rd.)	<u>Bubalus bubalis</u>	4♂, 1♀	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1075C	17 Oct 1963	Lahore	Narang, 24 mi. NE of Lahore (Shahdara-Narang RWL)	<u>Bubalus bubalis</u>	1♀	Nazeer M. Khan
C 1079C	18 Oct 1963	"	Bheni, 38 mi. NE of Lahore (Shahdara-Narang Rd.)	<u>Bos indicus</u>	1♀	"
C 1080B	18 Oct 1963	"	Kakkeki, 42 mi NE of Lahore (Shahdara-Narang Rd.)	"	1♂, 3♀	"
C 1082B	18 Oct 1963	"	Talwara, 24 mi. NE of Lahore (Shahdara-Narang Rd.)	<u>Bubalus bubalis</u>	1♀	"
C 1084B	19 Oct 1963	"	Lahore City	"	2♂	"
C 1087A	29 Oct 1963	"	Soral, 45 mi. SW of Lahore near Khundla More	<u>Bos indicus</u>	1♂	"
C 1093B	4 Nov 1963	"	Shakargarh, 35 mi. ESE of Sialkot	<u>Bubalus bubalis</u>	3♂, 2♀	"
C 1097B	5 Nov 1963	"	Alipur, 34 mi. SE of Sialkot	"	2♂	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1098B	5 Nov 1963	Lahore	Gunna, 8 mi. SSE of Sialkot	<u>Bubalus bubalis</u>	1♀	Nazeer M. Khan
C 1105B	11 Nov 1963	"	Pindi Bhattian, Gujranwala Dist., 44 mi. WNW of Sheikhpura	"	1♀	"
C 1106B	11 Nov 1963	"	"	<u>Bos indicus</u>	1♂, 1♀	"
C 1113C	14 Nov 1963	Sargodha	Tandianwala, 30 mi. S. of Lyallpur	"	1♀	"
C 1117C	14 Nov 1963	"	Jaranwala, 23 mi. SE of Lyallpur (Lahore Rd.)	"	1♂	"
C 1118C	16 Nov 1963	"	8 mi. NW of Jaranwala (on Lyallpur Rd.)	<u>Bubalus bubalis</u>	1♂	"
C 1120C	16 Nov 1963	"	24 mi. NW of Jaranwala (on Lyallpur Rd.)	<u>Bos indicus</u>	1♂	"
C 1122B	16 Nov 1963	Lahore	16 mi. SW of Lahore (Sharqpur Rd.)	<u>Bubalus bubalis</u>	2♀	"
C 1132B	4 Dec 1963	Lahore	12 mi. SE of Lahore (Harike Rd.)	<u>Bubalus bubalis</u>	1♂	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1138B	5 Dec 1963	Lahore	7 mi SW of Lahore (Multan Rd.)	<u>Bubalus bubalis</u>	1♀	Nazeer M. Khan
C 1139B	5 Dec 1963	"	8 mi. SW of Lahore (Multan Rd.)	"	1♂	"
C 1161A	24 Dec 1963	"	Nathoki, 24 mi. SE of Lahore (Harike Rd.)	"	1♂	"
C 1165C	24 Dec 1963	"	Mindianwala, 15 mi. SE of Lahore (Harike Rd.)	"	1♂	"
C 1168B	27 Dec 1963	"	Barki, 17 mi. SE of Lahore (Harike Rd.)	"	1♂	"
C 1174B	29 Dec 1963	"	Mojoke, 9 mi. from Border (on Harike Rd.) Lahore Dist.	<u>Bos indicus</u>	1♂	"
C 1175B	29 Dec 1963	"	Narwar, 4 mi. S. of Wagah Border	"	2♂	"
C 1176B	29 Dec 1963	"	Dhoori, 6 mi. N. of 21 mi. Marker from Lahore (Harike Rd.)	"	2♂	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1178B	30 Dec 1963	Lahore	11 mi. S. of Lahore (Ferozepur Rd.)	<u>Bubalus bubalis</u>	1♂	Nazeer M. Khan
C 1180B	30 Dec 1963	"	10 mi. S. of Lahore	"	1♂	"
C 1188B	5 Feb 1964	Hyderabad	Umarkot, Thar Parkar Dist.	"	2♂, 1♀	"
C 1189	5 Feb 1964	"	"	<u>Camelus dromedarius</u>	11♂, 6♀	"
C 1191B	5 Feb 1964	"	Chanana, 24 mi. E. of Umarkot, Thar Parkar Dist.	"	16♂, 8♀	"
C 1192B	5 Feb 1964	"	Khokhropar, 38 mi. NE of Umarkot, Thar Parkar Dist.	<u>Bos indicus</u>	17♂, 15♀	"
C 1193	5 Feb 1964	"	Khokharo Parkar, 20 mi. NE of Umarkot Thar Parkar Dist.	<u>Camelus dromedarius</u>	14♂, 19♀	"
C 1194	5 Feb 1964	"	17 mi. NE of Umarkot	"	8♂, 11♀	"
C 1195A	5 Feb 1964	"	13 mi. NE of Umarkot	"	8♂, 14♀	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1196	6 Feb 1964	Hyderabad	Doran, 14 - 25 mi. E. of Umarkot, Thar Parkar Dist.	<u>Camelus dromedarius</u>	51♂, 45♀	Nazeer M. Khan
C 1197	6 Feb 1964	"	Bojera, 22 mi. E. of Umarkot, Thar Parkar Dist.	"	10♂, 11♀	"
C 1198	6 Feb 1964	"	Sukhpal, 11 mi. E. of Umarkot, Thar Parkar Dist.	"	9♂, 6♀	"
C 1199	6 Feb 1964	"	Khan Sahab, 10 mi. E. of Umarkot, Thar Parkar Dist.	"	6♂, 4♀	"
C 1200	6 Feb 1964	"	Panjabi Goth, 10 mi. E. of Umarkot, Thar Parkar Dist.	"	13♂, 10♀	"
C 1202	7 Feb 1964	"	Balar, 24 mi. N. of Umarkot	"	13♂	"
C 1203A	7 Feb 1964	"	11 mi. NE of Umarkot Thar Parkar Dist.	"	16♂, 7♀	"
C 1204	7 Feb 1964	"	"	<u>Capra hircus</u>	4♂, 1♀	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1205	7 Feb 1964	Hyderabad	Kiaser, 9 mi. E. of Umarkot	<u>Camelus dromedarius</u>	7♂, 3♀	Nazeer M. Khan
C 1206	7 Feb 1964	"	Kaloi, 13 mi. NE of Umarkot, Thar Parkar Dist.	"	3♂, 1♀	"
C 1207	7 Feb 1964	"	"	<u>Capra hircus</u>	7♂, 3♀	"
C 1209	7 Feb 1964	"	Jagirwala, 10 mi. NE of Umarkot, Thar Parkar Dist.	<u>Camelus dromedarius</u>	2♂, 6♀	"
C 1210B	7 Feb 1964	"	"	<u>Capra hircus</u>	11♂, 3♀	"
C 1212	7 Feb 1964	"	Hirabad, 16 mi. NE of Umarkot, Thar Parkar Dist.	<u>Camelus dromedarius</u>	8♂, 9♀	"
C 1213B	7 Feb 1964	"	Umarkot, Thar Parkar Dist.	<u>Capra hircus</u>	8♂, 6♀	"
C 1214A	7 Feb 1964	"	"	<u>Ovis aries</u>	8♂	"
C 1215B	7 Feb 1964	"	7 mi. W. of Umarkot, Thar Parkar Dist.	<u>Camelus dromedarius</u>	30♂, 26♀	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1216A	7 Feb 1963	Hyderabad	Umarkot, Thar Parkar Dist.	<u>Camelus dromedarius</u>	3♂, 1♀	Nazeer M. Khan
C 1221	8 Feb 1964	"	Goth Soofi, 7 mi. W. of Umarkot, Thar Parkar Dist.	"	4♂, 4♀	"
C 1224B	23 Feb 1964	Lahore	17 mi. SE of Lahore (Harike Rd.)	<u>Bubalus bubalis</u>	3♂	"
C 1226B	27 Feb 1964	"	12 mi. SSE of Lahore	"	1♀	"
C 1227B	27 Feb 1964	"	Malikpur, 13 mi. SE of Lahore (1 mi. S. of Harike Rd.)	"	1♂, 1♀	"
C 1245A	15 Mar 1964	Rawalpindi	Kahuta, 20 mi. E. of Rawalpindi	<u>Camelus dromedarius</u>	1♂	"
C 1250	5 Feb 1964	Hyderabad	Kerla, 30 mi. E. of Umarkot, Thar Parkar Dist.	"	5♂, 7♀	"
C 1251	9 Feb 1964	"	Mirpur Khas, Thar Parkar Dist.	<u>Bos indicus</u>	8♂, 3♀	"



TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1262C	18 Mar 1964	Peshawar	Mansehra, 50 mi. N. of Rawalpindi	<u>Bubalus bubalis</u>	1♀	Nazeer M. Khan
C 1270B	24 Mar 1964	"	Mardan City	<u>Camelus dromedarius</u>	5♂, 1♀	"
C 1298B	20 Apr 1964	Lahore	13 mi. E. of Lahore	<u>Bubalus bubalis</u>	1♀	"
C 1299B	20 Apr 1964	"	16 mi. E. of Lahore	<u>Bos indicus</u>	1♂, 1♀	"
C 1308C	29 Apr 1964	"	Aulakh, Balloki H. W. Area, Lahore Dist.	<u>Bubalus bubalis</u>	1♂	"
C 1311C	8 May 1964	"	17 mi. E. of Lahore (Wagah Rd.)	"	2♂	"
C 1315B	13 May 1964	"	18 mi. SE of Lahore (Harike Rd.)	"	1♂	"
C 1330C	26 May 1964	"	12 mi. NE of Lahore	"	1♀	"
C 1345C	11 Jun 1964	"	Jallo, 13 mi. E. of Lahore (Wagah Rd.)	<u>Bos indicus</u>	2♂, 2♀	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1346B	11 Jun 1964	Lahore	Pathe, 17 mi. E. of Lahore (Amritsar RWL)	<u>Bubalus bubalis</u>	1♂, 1♀	Nazeer M. Khan
C 1347C	11 Jun 1964	"	"	<u>Bos indicus</u>	12♀	"
C 1348B	14 Jul 1964	"	Tera, 8 mi. E. of Lahore	<u>Bubalus bubalis</u>	3♂, 1♀	"
C 1353B	16 Jul 1964	"	Jaman, 22 mi. SSE of Lahore	"	1♂	"
C 1354B	16 Jul 1964	"	Barki, 17 mi. SE of Lahore (Harike Rd.)	"	1♀	"
C 1361B	19 Jul 1964	"	Balloki H. W., Lahore Dist.	<u>Camelus dromedarius</u>	4♂, 2♀	"
C 1363B	19 Jul 1964	"	Maliwal, 4 mi. N. of Balloki H. W., Lahore	"	4♂	"
C 1366B	27 Jul 1964	"	2 mi. N. of Lahore	<u>Bos indicus</u>	1♂	"
C 1367B	27 Jul 1964	"	Karol, 3 mi. N. of Lahore	"	1♂	"

TABLE 24. Material examined and identified as Hyalomma dromedarii Koch, 1844.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1369B	28 Jul 1964	Lahore	Pir Naseer, 8 mi. E. of Lahore	<u>Bos indicus</u>	5♂, 4♀	Nazeer M. Khan
C 1370B	28 Jul 1964	"	"	<u>Bubalus bubalis</u>	2♂, 1♀	"
C 1371B	28 Jul 1964	"	11 mi. E. of Lahore	<u>Bos indicus</u>	2♂, 1♀	"
C 1373B	28 Jul 1964	"	7 mi. E. of Lahore	<u>Bubalus bubalis</u>	1♂	"
C 1386C	21 Aug 1964	"	13 mi. SE of Lahore (Harike Rd.)	<u>Bos indicus</u>	1♀	"
C 1388C	30 Jul 1964	"	Duggra, 9 mi. E. of Lahore, (Wagah Rd.)	<u>Bubalus bubalis</u>	4♂	"

TABLE 25. Material examined and identified as Hyalomma impeltatum Schulze and Schlottke, 1929.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 34	27 Jan 1963	Bahawalpur	Bhootan, 14 mi. SE of Yazman	<u>Ovis aries</u>	1♂, 1♀	V. C. McCarthy and Z. B. Mirza

TABLE 26. Material examined and identified as Hyalomma marginatum isaaci Sharif, 1928.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 26B	21 Nov 1962	Lahore	Kot Abdul Malik Sheikhupura Dist.	<u>Bos indicus</u>	1♂	Z. B. Mirza
C 28C	25 Jan 1963	Multan	Haveli, 12 mi. NW of Sulemanki H. W.	<u>Camelus dromedarius</u>	1♂	V. C. McCarthy and Z. B. Mirza
C 68B	5 Feb 1963	Hyderabad	Pithapur, on Salt Flats near Nagar Parkar	<u>Gazella gazella bennetti</u>	1♂	"
C 117B	23 Mar 1963	D. I. Khan	D. I. Khan City	<u>Ovis aries</u>	1♂	"
C 136C	26 Mar 1963	Quetta	18 mi. SW of Ft. Sandeman, Babur Tribe, 18 mi. out on Loralai Rd. 4,500 ft.	"	1♂	"
C 157B	2 Apr 1963	"	Dalbandin	<u>Camelus dromedarius</u>	1♂	"
C 185	28 Apr 1963	Lahore	20 mi. SSE of Kasur	<u>Sus scrofa cristatus</u>	1♂	V. C. McCarthy
C 213B	13 Apr 1963	Multan	Taunsa Barrage	<u>Camelus dromedarius</u>	2♂, 2♀	V. C. McCarthy and Z. B. Mirza

TABLE 26. Material examined and identified as Hyalomma marginatum isaaci Sharif, 1928.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 222D	23 Apr 1963	Lahore	Balloki H. W., 40 mi. from Lahore	<u>Bubalus bubalis</u>	3♂	Z. B. Mirza
C 224A	23 Apr 1963	"	"	<u>Camelus dromedarius</u>	11♂, 2♀	"
C 230B	24 Apr 1963	"	Gondlawala, 4 mi. from Gujranwala	<u>Bubalus bubalis</u>	1♂	"
C 235E	3 May 1963	Bahawalpur	21 mi. SE of Bahawalpur	<u>Bos indicus</u>	1♂	V. C. McCarthy and Z. B. Mirza
C 238C	2 May 1963	"	"	<u>Capra hircus</u>	2♂, 1♀	"
C 245C	5 May 1963	"	10 mi. S. of Dera Nawab Sahib	<u>Camelus dromedarius</u>	1♂	"
C 264D	12 May 1963	Hyderabad	Buhara, 62 mi. ESE of Karachi	<u>Bos indicus</u>	2♂	"
C 265B	12 May 1963	"	"	<u>Bubalus bubalis</u>	1♂	"
C 266	12 May 1963	"	Kori Goth, 82 mi. SE of Karachi	<u>Ovis aries</u>	9♂	"

TABLE 26. Material examined and identified as Hyalomma marginatum isaaci Sharif, -1928.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 289B	26 May 1963	Peshawar	Swat River Bank near Saidu Sharif, Swat State	<u>Bubalus bubalis</u>	6♂	V. C. McCarthy and Z. B. Mirza
C 290	26 May 1963	"		<u>Bos indicus</u>	6♂, 1♀	"
C 291B	26 May 1963	"	15 mi. W. of Saidu Sharif, Swat State	<u>Capra hircus</u>	2♂, 3♀	"
C 307	2 Jun 1963	"	3 mi. E. of Mansehra	<u>Bos indicus</u>	2♂	"
C 316	3 Jun 1963	"	Balakot, Kagan Valley	<u>Camelus dromedarius</u>	2♂	"
C 321B	6 Jun 1963	Rawalpindi	4 mi. SE of Rawalpindi	<u>Bos indicus</u>	1♀	"
C 322	7 Jun 1963	Peshawar	5 mi. N. of Islamabad (Pak)	<u>Bubalus bubalis</u>	2♂, 2♀	"
C 343C	18 Jul 1963	Multan	Taunsa Barrage, W. Bank	<u>Bos indicus</u>	1♂, 1♀	Z. B. Mirza
C 373B	26 Jul 1963	Quetta	Gulistan, 45 mi. NNW of Quetta	<u>Ovis aries</u>	1♀	"
C 410C	10 Aug 1963	Khairpur	Nawabshah	<u>Camelus dromedarius</u>	2♂	"

TABLE 26. Material examined and identified as Hyalomma marginatum isaaci Sharif, -1928.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 417D	12 Aug 1963	Khairpur	Ubauro, 70 mi. NE of Sukkur	<u>Bubalus bubalis</u>	2♂	Z. B. Mirza
C 444D	14 Aug 1963	Bahawalpur	10 mi. E. of Islam H. W.	"	12♂, 4♀	"
C 465C	18 Sept 1963	Peshawar	Mansehra	"	3♂	V. C. McCarthy and Z. B. Mirza
C 483D	24 Sept 1963	Rawalpindi	13 mi. W. of Rawalpindi	<u>Bos indicus</u>	1♂	"
C 486B	25 Sept 1963	"	18 mi. NW of Rawalpindi on Taxilla Rd.	"	2♂	"
C 492B	26 Sept 1963	"	18 mi. E. of Rawalpindi (on Azad Kashmir Rd.)	<u>Bubalus bubalis</u>	5♂, 1♀	"
C 502C	21 Oct 1963	Quetta	3 mi. from Ziarat (Sibi) on Quetta Rd. 6,000 ft.	<u>Capra hircus</u>	2♂	"
C 511B	29 Oct 1963	Kalat	Kalat	<u>Alectoris graeca koroviakovi</u>	1♀	"



TABLE 26. Material examined and identified as Hyalomma marginatum isaaci Sharif, 1928.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 537E	3 May 1964	Azad Kashmir	9 mi. NE of Kohala on Muzaffarabad Rd.	<u>Bos indicus</u>	25♂, 4♀	Traub Group
C 597D	13 Aug 1964	Peshawar	Amandara, Malakand Agency 3,750 ft.	<u>Camelus dromedarius</u>	10♂, 1♀	"
C 674	23 Apr 1963	"	Saidu Sharif, Swat State	<u>Bos indicus</u>	2♂	"
C 785C	9 Nov 1963	Karachi	16 mi. NE of Karachi on T. B. Khan Rd.	<u>Camelus dromedarius</u>	2♂	V. C. McCarthy and Z. B. Mirza
C 791	13 Nov 1963	Hyderabad	8 mi. W. of Tatta (on Karachi Rd.)	<u>Bos indicus</u>	8♂, 3♀	"
C 795B	13 Nov 1963	"	Tatta	<u>Ovis aries</u>	2♂	"
C 818B	3 Mar 1964	Lahore	Balloki H. W., Lahore	<u>Bubalus bubalis</u>	1♂	"
C 831	25 Mar 1964	Quetta	35 mi. S of Ft. Sandeman (on Loralai Rd.)	<u>Ovis aries</u>	1♂	"
C 862	25 Jun 1964	Peshawar	4 mi. S. of Saidu Sharif on Marghuzar Rd. Swat State	<u>Bos indicus</u>	1♂, 1♀	Z. B. Mirza and Nazeer M. Khan

TABLE 26. Material examined and identified as Hyalomma marginatum isaaci Sharif, -1928.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 904D	1963	Sargodha	Shahpur, Mianwali Dist.	<u>Bubalus bubalis</u>	6♂	Dept. of Animal Husbandry
C 935B	18 Sept 1963	Hyderabad	Nagar Parkar, Thar Parkar Dist.	<u>Bos indicus</u>	1♂, 1♀	"
C 940B	28 Aug 1963	Karachi	Hab Chowki (Hab River, near Karachi on Bela Rd.	<u>Camelus dromedarius</u>	4♂, 2♀	"
C 948D	8 Jun 1963	Sargodha	Mianwali, Sargodha Dist.	"	1♂	"
C 959B	April 1963	Lahore	Phooklian, Bajwat Area, Sialkot Dist.	<u>Bubalus bubalis</u>	1♂	"
C 987C	20 Aug 1963	Lahore	Paddri, 8 mi. SE of Lahore on Harike Rd.	"	11♂, 12♀	Nazeer M. Khan
C 989C	21 Aug 1963	"	Korian, 14 mi. SE of Lahore (on Harike Rd.)	"	5♂, 1♀	"
C 996C	29 Aug 1963	"	Balloki, 40 mi. SW of Lahore	"	34♂, 7♀	"
C 997C	29 Aug 1963	"	Thata Khokhar, near Balloki, Lahore Dist.	"	7♂, 11♀	"

TABLE 26. Material examined and identified as Hyalomma marginatum isaaci Sharif, 1928.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 998	29 Aug 1963	Lahore	Thata Khokhar, Balloki, Lahore Dist.	<u>Bos indicus</u>	6♂, 1♀	Nazeer M. Khan
C 999	29 Aug 1963	"	Torri, near Balloki, Lahore Dist.	<u>Ovis aries</u>	12♂, 1♀	"
C 1000	30 Aug 1963	"	8 mi. SW of Balloki, Lahore Dist.	<u>Camelus dromedarius</u>	1♀	"
C 1001B	30 Aug 1963	"	"	"	3♂	"
C 1005	30 Aug 1963	"	"	<u>Bubalus bubalis</u>	2♂, 2♀	"
C 1007B	6 Sept 1963	"	10 mi. above Main Bridge on Ravi, Lahore	"	18♂, 1♀	"
C 1008	6 Sept 1963	"	Rat Garh, 10 mi. E. of Lahore (Wagah Rd.)	"	4♂	"
C 1009B	6 Sept 1963	"	8 mi. above Main Ravi Bridge, Lahore	"	8♂, 4♀	"
C 1011	7 Sept 1963	"	9 mi. above Main Ravi Bridge, Lahore	"	19♂	"

TABLE 26. Material examined and identified as Hyalomma marginatum isaaci Sharif, -1928.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1015A	9 Sept 1963	Lahore	Bahmanabad, 12 mi. SE of Lahore (Harike Rd.)	<u>Bos indicus</u>	1♂, 1♀	Nazeer M. Khan
C 1016	9 Sept 1963	"	"	<u>Bubalus bubalis</u>	8♂, 2♀	"
C 1020C	9 Sept 1963	"	Dial, 18 mi. E. of Lahore, Wagah Rd.	"	1♂	"
C 1044C	14 Sept 1963	"	Bakkarke, 19 mi. SW of Kasur, 4 mi. from Border	"	1♂	"
C 1053C	21 Sept 1963	"	Balloki H. W., 40 mi. SW of Lahore	"	2♂	"
C 1054C	24 Sept 1963	"	Ferozewala, 6 mi. N. of Lahore (Gujranwala Rd.)	"	1♂	"
C 1055	24 Sept 1963	"	Dargai Gill, 10 mi. N. of Lahore	"	7♂, 3♀	"
C 1056	24 Sept 1963	"	"	<u>Camelus dromedarius</u>	3♂	"

TABLE 26. Material examined and identified as Hyalomma marginatum isaaci Sharif, - 1928.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1058A	25 Sept 1963	Lahore	Sharakpur Khurd, 8 mi. NW of Lahore (Lyallpur Rd.)	<u>Bos indicus</u>	1♂	Nazeer M. Khan
C 1063C	26 Sept 1963	"	Budhoke, 10 mi. NW of Lahore (Lyallpur Rd.)	<u>Bubalus</u> <u>bubalis</u>	1♂	"
C 1072B	17 Oct 1963	"	Kotli, 12 mi. E. of Lahore (Wagah Rd.)	<u>Ovis aries</u>	1♂	"
C 1078B	18 Oct 1963	"	Bheni, 38 mi. NE of Lahore (Shahdara- Narang Rd.)	<u>Bubalus</u> <u>bubalis</u>	1♂	"
C 1083B	19 Oct 1963	"	Lahore City	"	1♂	"
C 1087B	29 Oct 1963	"	Soral, 45 mi. SW of Lahore (near Khundla More)	<u>Bos indicus</u>	2♂	"
C 1089B	1 Nov 1963	"	Gujranwala	<u>Bubalus bubalis</u>	1♀	"
C 1096B	4 Nov 1963	"	Chandra, 8 mi. N. of Narowal, Sialkot Dist.	"	3♂	"

TABLE 26. Material examined and identified as Hyalomma marginatum isaaci Sharif, -1928.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1097C	5 Nov 1963	Lahore	Alipur, 34 mi. SE of Sialkot	<u>Bubalus bubalis</u>	1♂	Nazeer M. Khan
C 1102B	8 Nov 1963	"	Hafizabad, 31 mi. W. of Gujranwala	"	2♂	"
C 1103B	8 Nov 1963	"	26 mi. W. of Gujranwala	"	1♂	"
C 1104B	8 Nov 1963	"	Gujranwala	"	4♂, 2♀	"
C 1108B	12 Nov 1963	"	13 mi. from Pindi Bhatian (on Sheikhpura Rd.) 31 mi. WNW of Sheikhpura	"	1♀	"
C 1117D	16 Nov 1963	Sargodha	Jaranwala, 23 mi. SE of Lyallpur (Lahore Rd.)	<u>Bos indicus</u>	1♂	"
C 1119B	16 Nov 1963	"	8 mi. NW of Jaranwala (on Lyallpur Rd.)	"	3♂	"
C 1120D	16 Nov 1963	"	24 mi. NW of Jaranwala (on Lyallpur Rd.)	"	2♂	"
C 1122C	16 Nov 1963	Lahore	16 mi. SW of Lahore (Sharqpur Rd.)	<u>Bubalus bubalis</u>	3♂	"

TABLE 26. Material examined and identified as Hyalomma marginatum isaaci Sharif, 1928.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1132C	4 Dec 1963	Lahore	12 mi. SE of Lahore (Harike Rd.)	<u>Bubalus bubalis</u>	3♂	Nazeer M. Khan
C 1151B	9 Dec 1963	"	19 mi. SE of Sheik-hupura (Lahore Rd.)	"	1♂	"
C 1155B	23 Dec 1963	"	12 mi. SE of Lahore (Harike Rd.)	"	1♂	"
C 1158C	23 Dec 1963	"	25 mi. SE of Lahore (Harike Rd.)	<u>Bos indicus</u>	1♂	"
C 1162B	24 Dec 1963	"	Dhoori, 20 mi. SE of Lahore (Harike Rd.)	<u>Bubalus bubalis</u>	1♂	"
C 1168C	27 Dec 1963	"	Barki, 17 mi. SE of Lahore (Harike Rd.)	"	2♂, 1♀	"
C 1169B	27 Dec 1963	"	Barki, 20 mi. SE of Lahore (Harike Rd.)	"	3♂	"
C 1172B	28 Dec 1963	"	Karanke, 7 mi. from Border (Harike Rd.) Lahore Dist.	"	2♂	"
C 1183	10 Jan 1964	"	Kahna, 18 mi. S. of Lahore	"	3♂	"

TABLE 26. Material examined and identified as Hyalomma marginatum isaaci Sharif, 1928.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1224C	23 Feb 1964	Lahore	17 mi. SE of Lahore (Harike Rd.)	<u>Bubalus bubalis</u>	3♂, 2♀	Nazeer M. Khan
C 1249	15 Mar 1964	Rawalpindi	Saidpur, 19 mi. N. of Rawalpindi (Nomads heading North)	<u>Ovis aries</u>	7♂, 1♀	"
C 1252	15 Mar 1964	"	Nurpur, 16 mi. N. of Rawalpindi	"	1♂, 1♀	"
C 1253	15 Mar 1964	"	"	<u>Bubalus bubalis</u>	4♂	"
C 1255A	15 Mar 1964	"	Mulwar, 22 mi. N. of Rawalpindi	<u>Ovis aries</u>	5♂, 3♀	"
C 1256A	15 Mar 1964	"	"	<u>Capra hircus</u>	2♂, 1♀	"
C 1257	15 Mar 1964	Peshawar	Khooi, 26 mi. N. of Rawalpindi	<u>Ovis aries</u>	3♂, 1♀	"
C 1258	15 Mar 1964	"	"	<u>Bos indicus</u>	2♂, 1♀	"
C 1259B	16 Mar 1964	Rawalpindi	Karpa, 18 mi. NE of Rawalpindi (Lehtrar Rd.)	<u>Ovis aries</u>	3♂	"



TABLE 26. Material examined and identified as Hyalomma marginatum isaaci Sharif, 1928.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1270C	24 Mar 1964	Peshawar	Mardan City	<u>Camelus dromedarius</u>	7♂, 2♀	Nazeer M. Khan
C 1275B	25 Mar 1964	"	Swabi, 29 mi. E. of Mardan	<u>Bos indicus</u>	1♂	"
C 1276B	25 Mar 1964	"	"	<u>Ovis aries</u>	1♂	"
C 1295	1 Apr 1964	Rawalpindi	9 mi. SE of Rawalpindi (Jhelum Rd.	<u>Bubalus bubalis</u>	3♂, 1♀	"
C 1300B	28 Apr 1964	Lahore	Balloki, Lahore Dist.	"	4♂, 3♀	"
C 1303B	28 Apr 1964	"	Balloki H. W., Lahore	"	1♂	"
C 1308D	29 Apr 1964	"	Aulakh, Balloki H. W. Area, Lahore Dist.	"	1♂	"
C 1310B	8 May 1964	"	15 mi. E. of Lahore (Wagah Rd.)	"	3♂	"
C 1311D	8 May 1964	"	17 mi. E. of Lahore (Wagah Rd.)	"	5♂, 1♀	"
C 1318B	21 May 1964	"	Sagian, 9 mi. N. of Lahore	<u>Bos indicus</u>	1♂	"

TABLE 26. Material examined and identified as Hyalomma marginatum isaaci Sharif, 1928.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1322B	25 May 1964	Lahore	11 mi. NE of Lahore	<u>Ovis aries</u>	3♂	Nazeer M. Khan
C 1323C	25 May 1964	"	"	<u>Bubalus bubalis</u>	7♂, 4♀	"
C 1330D	26 May 1964	"	12 mi. NE of Lahore	"	1♂	"
C 1333A	28 May 1964	"	"	"	3♂, 1♀	"
C 1334B	28 May 1964	"	Jandra, 10 mi. SE of Lahore (Harike Rd.)	<u>Bos indicus</u>	1♂	"
C 1335C	28 May 1964	"	"	<u>Bubalus bubalis</u>	2♂	"
C 1338C	28 May 1964	"	Malakpur, 11 mi. SE of Lahore (Harike Rd.)	<u>Bos indicus</u>	3♂	"
C 1348C	14 Jul 1964	"	Tera, 8 mi. E. of Lahore	<u>Bubalus bubalis</u>	2♂	"
C 1361C	19 Jul 1964	"	Balloki H. W., Lahore Dist.	<u>Camelus dromedarius</u>	7♂, 1♀	"
C 1363C	19 Jul 1964	"	Maliwal, 4 mi. N. of Balloki H.W., Lahore Dist.	"	8♂	"

TABLE 26. Material examined and identified as Hyalomma marginatum isaaci Sharif, 1928.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1364B	19 Jul 1964	Lahore	Khokhar, 3 mi. S. of Balloki H. W., Lahore	<u>Bubalus</u> <u>bubalis</u>	5♂	Nazeer M. Khan
C 1387B	21 Aug 1964	"	Barki, 17 mi. SE of Lahore (Harike Rd.)	"	5♂, 2♀	"
C 1390	22 Aug 1964	"	Maniala, 16 mi. E. of Lahore	"	10♂, 3♀	"

TABLE 27. Material examined and identified as Hyalomma marginatum turanicum Pomerantsev, 1946.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 122B	24 Mar 1963	D. I. Khan	3 mi. W. of D. I. Khan on Paharpur Canal	<u>Bos indicus</u>	2♀	V. C. McCarthy and Z. B. Mirza
C 132E	26 Mar 1963	Quetta	Ft. Sandeman, 4,500 ft.	Misc. domestic animals (sheep, goats, cattle, camels, buffalo)	80 ♂, ♀	Dept. of Animal Husbandry (West Pakistan)
C 135E	26 Mar 1963	"	Ft. Sandeman, 4,500 ft.	"	24♂, 4♀	"
C 136B	26 Mar 1963	"	Ft. Sandeman, 4,500 ft., Babur Tribe, 18 mi. out on Loralai Rd.	<u>Ovis aries</u>	1♂	V. C. McCarthy and Z. B. Mirza
C 137D	27 Mar 1963	"	Suleman Zai, 4,500 ft. (30 mi. from Ft. Sandeman on Loralai Rd.	<u>Ovis aries</u>	6♂, 1♀	"
C 146	30 Mar 1963	"	Urrak, 14 mi. E. of Quetta, 6,994 ft.	<u>Ovis aries</u>	1♂	"
C 148E	30 Mar 1963	"	"	<u>Ovis aries</u>	10♂, 1♀	"
C 149C	30 Mar 1963	"	"	<u>Capra hircus</u>	1♀	"

TABLE 27. Material examined and identified as Hyalomma marginatum turanicum Pomerantsev, 1946.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 151C	30 Mar 1963	Quetta	Hanna, 8 mi. E. of Quetta, 6,322 ft.	<u>Ovis aries</u>	1♂	V. C. McCarthy and Z. B. Mirza
C 152	30 Mar 1963	"	Urrak, 14 mi. E. of Quetta, 6,994 ft.	<u>Bos indicus</u>	1♂	"
C 154D	31 Mar 1963	"	Chaman, 60 mi. NNW of Quetta	<u>Camelus dromedarius</u>	5♂	"
C 155C	31 Mar 1963	"	5 mi. S. of Chaman on Baghrat Top Road	<u>Ovis aries</u>	1♂	"
C 172	8 Apr 1963	Kalat	Kalat	<u>Capra hircus</u>	8♂, 1♀	"
C 188	8 Apr 1963	"	Kalat City	<u>Ovis aries</u>	1♂, 2♀	"
C 191B	8 Apr 1963	"	Ziarat, 12 mi. N. of Kalat on Quetta Rd.	<u>Camelus dromedarius</u>	1♂	"
C 193A	8 Apr 1963	"	"	<u>Bos indicus</u>	1♂, 1♀	"
C 197B	9 Apr 1963	Quetta	6 mi. E. of Ziarat on Loralai Rd.	<u>Ovis aries</u>	10♂, 1♀	"
C 199B	10 Apr 1963	"	Zangiwal, 3 mi. E. of Loralai	"	7♂, 2♀	"

TABLE 27. Material examined and identified as Hyalomma marginatum turanicum Pomerantsev, 1946.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 200A	10 Apr 1963	Quetta	Zangi Wal, 3 mi. E. of Loralai	<u>Ovis aries</u>	7♂, 3♀	V. C. McCarthy and Z. B. Mirza
C 202	10 Apr 1963	"	Rest House, Loralai	McCarthy (Collector) Not attached	1♀	V. C. McCarthy
C 203B	10 Apr 1963	"	11 mi. W. of Loralai on Ziarat Rd.	<u>Bos indicus</u>	3♂, 2♀	V. C. McCarthy and Z. B. Mirza
C 205B	11 Apr 1963	"	4 mi. from Loralai on Kila Saif Ulla Rd.	<u>Ovis aries</u>	8♂, 3♀	"
C 206B	11 Apr 1963	"	"	<u>Capra hircus</u>	8♂, 12♀	"
C 207	11 Apr 1963	"	18 mi. NW of Loralai on Kila Saif Ulla Rd.	<u>Ovis aries</u>	12, 4♀	"
C 208B	11 Apr 1963	"	14 mi. NW of Loralai on Kila Saif Ulla Rd.	<u>Bos indicus</u>	13♂, 3♀	"
C 215C	13 Apr 1963	Multan	14 mi. E. of Taunsa Barrage on Rangpur Rd.	<u>Camelus dromedarius</u>	1♂	"
C 233B	2 May 1963	Bahawalpur	9 mi. NE from Bahawalpur on Bahawalnagar Rd.	"	2♂	"

TABLE 27. Material examined and identified as Hyalomma marginatum turanicum Pomerantsev, 1946.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 245D	5 May 1963	Bahawalpur	10 mi. S. of Dera Nawab Sahib	<u>Camelus dromedarius</u>	1♂	V. C. McCarthy and Z. B. Mirza
C 263C	11 May 1963	Karachi	14 mi. ENE of Karachi on Thano Bula Khan Rd.	<u>Bos indicus</u>	1♂	"
C 328B	13 Jun 1963	Peshawar	Chilas	<u>Capra hircus</u>	10♂	Z. B. Mirza
C 354A	20 Jul 1963	Quetta	Kingri, 83 mi. E. of Loralai	<u>Ovis aries</u>	10♂, 1♀	"
C 359	22 Jul 1963	"	Ziarat, 63 mi. E. of Quetta, 8,000 ft.	"	7♂, 4♀	"
C 367	24 Jul 1963	"	8 mi. W. of Ziarat 6,000 ft.	"	3♂, 7♀	"
C 368B	24 Jul 1963	"	8 mi. W. of Ziarat on Quetta Rd., 6,000 ft.	<u>Camelus dromedarius</u>	5♂	"
C 371	24 Jul 1963	"	"	<u>Bos indicus</u>	5♂	"
C 373C	26 Jul 1963	"	Gulistan, 45 mi. NNW of Quetta	<u>Ovis aries</u>	1♂	"

TABLE 27. Material examined and identified as Hyalomma marginatum turanicum Pomerantsev, 1946.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 374B	26 Jul 1963	Quetta	Gulistan, 45 mi. NNW of Quetta	<u>Camelus dromedarius</u>	2♂	Z. B. Mirza
C 381B	28 Jul 1963	"	Chaman	"	7♂, 2♀	"
C 391D	1 Aug 1963	Kalat	Surab, Kalat Dist.	<u>Bos indicus</u>	6♂	"
C 392D	1 Aug 1963	"	"	<u>Camelus dromedarius</u>	5♂, 2♀	"
C 393C	1 Aug 1963	"	8 mi. N. of Surab	<u>Bos indicus</u>	2♂	"
C 395	1 Aug 1963	"	Surab	<u>Ovis aries</u>	1♂	"
C 406C	8 Aug 1963	Karachi	Hawks Bay	"	2♂	"
C 501	19 Oct 1963	Quetta	Ziarat (Sibi), 8,040 ft.	<u>Lepus capensis tibetanus</u>	4♂, 8♀	V. C. McCarthy and Z. B. Mirza
C 505	21 Oct 1963	"	8 mi. W. of Ziarat on Quetta Rd., 6,000 ft.	<u>Ovis aries</u>	1♂	"
C 510A	27 Oct 1963	Kalat	Kalat	"	1♂, 1♀	"
C 573C	17 Jun 1964	Quetta	Gulistan, 35 mi. NW of Quetta, 7,000 ft.	<u>Camelus dromedarius</u>	1♀	Traub Group



TABLE 27. Material examined and identified as Hyalomma marginatum turanicum Pomerantsev, 1946.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 574E	13 June 1964	Quetta	Hindubagh, Zhob Dist.	<u>Bos indicus</u>	9♂	Traub Group
C 575B	14 June 1964	"	"	<u>Ovis aries</u>	10♂, 6♀	"
C 588C	13 June 1964 14 June 1964	"	"	"	16♂, 3♀	"
C 596	10 Aug 1964	Peshawar	Amandara, Malakand	- - - - -	1♀	"
C 757B	8 Aug 1964	"	Naltar, Gilgit	<u>Capra hircus</u>	1♂, 2♀	"
C 785D	9 Nov 1963	Karachi	16 mi. NE of Karachi on T. B. Khan Rd.	<u>Camelus dromedarius</u>	2♂	V. C. McCarthy and Z. B. Mirza
C 836	29 Mar 1964	Kalat	5 mi. S. of Mastung (on Kalat Rd.)	<u>Ovis aries</u>	1♀	"
C 849B	6 Apr 1964	"	5 mi. S. of Surab (on Khuzdar Rd.)	<u>Camelus dromedarius</u>	2♀	"
C 850B	6 Apr 1964	"	2 mi. SW of Surab (on Panjgur Rd.)	<u>Bos indicus</u>	1♂, 1♀	"
C 852C	9 Apr 1964	Quetta	10 mi. N. of Rakhni (on Kingri Rd.)	<u>Ovis aries</u>	9♂, 1♀	"
C 853A	9 Apr 1964	"	"	<u>Capra hircus</u>	2♂	"

TABLE 27. Material examined and identified as Hyalomma marginatum turanicum Pomerantsev, 1946.  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 854A	9 Apr 1964	Multan	Ft. Munro, D.G. Khan Dist.	<u>Ovis aries</u>	7♂, 6♀	V. C. McCarthy and Z. B. Mirza
C 855	9 Apr 1964	"	"	<u>Capra hircus</u>	5♂, 2♀	"
C 856B	3 Apr 1964	Kalat	Hoshab	<u>Camelus dromedarius</u>	9♂, 6♀	"
C 1260B	16 Mar 1964	Rawalpindi	Karpa, 18 mi. NE of Rawalpindi (Lehtrar Rd.)	<u>Bos indicus</u>	1♀	Nazeer M. Khan
C 1262B	18 Mar 1964	Peshawar	Mansehra, 50 mi. N. of Rawalpindi	<u>Bubalus bubalis</u>	1♂, 1♀	"

TABLE 28. Material examined and identified as Hyalomma schulzei Olenov, 1931.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 157C	2 Apr 1963	Quetta	Dalbandin	<u>Camelus dromedarius</u>	1♂, 2♀	V. C. McCarthy and Z. B. Mirza
C 158C	2 Apr 1963	"	Chagai, 36 mi. NNE of Dalbandin	"	3♂	"
C 160B	2 Apr 1963	"	7 mi. from Dalbandin on Nushki Rd.	"	2♂, 7♀	"
C 166B	5 Apr 1963	Kalat	Vashbodth, 3 mi. NE of Panjgur on Kalat Rd.	"	1♂, 1♀	"
C 513B	1 Nov 1963	Quetta	Nushki	"	1♂, 1♀	"
C 573B	17 Jun 1964	"	Gulistan, 35 mi. NW of Quetta, 7,000 ft.	"	1♂	Traub Group

TABLE 29. Material examined and identified as Ixodes persulcatus kaschmiricus Pomerantsev, 1948.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
- - - - -	- - -	Peshawar	Bogamang Glen	"martin"	1♀	Unknown

This collection is in the British Museum, where it is designated as "Ixodes ricinus".

TABLE 30. Material examined and identified as Ixodes redikorzevi redikorzevi Olenov, 1927.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 710	15 Sept 1964	Peshawar	Naran, Kagan Valley 7,900 ft.	<u>Rattus</u> sp.	1♀	Traub Group
C 717	7 Oct 1964	"	"	"	1♀	"
C 755	26 Jul 1964	"	Gitidas, Kagan Valley	<u>Alticola</u> sp.	1♀	"

TABLE 31. Material examined and identified as Ixodes stromi Filippova, 1957.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 708	July, 1964	Peshawar	Naran, Kagan Valley	<u>Alticola</u> sp.	1♀	Traub Group
C 735A	8 Aug 1964	"	Naltar, Gilgit 9,700 ft.	<u>Cricetulus</u> sp.	2♀	"
C 767A	12 Aug 1964	"	"	<u>Apodemus</u> sp.	1♀	"

TABLE 32. Material examined and identified as Rhipicephalus haemaphysaloides haemaphysaloides  
Supino, 1897.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 260E	11 May 1963	Karachi	24 mi. from Karachi on Thano Bula Khan Rd.	<u>Capra hircus</u>	4♂	V. C. McCarthy and Z. B. Mirza
C 264E	12 May 1963	Hyderabad	Buhara 62 mi. ESE of Karachi	<u>Bos indicus</u>	1♂, 1♀	"
C 274B	14 May 1963	Khairpur	5 mi. downstream from Gumbat Rest House on Rohri Canal, 20 mi. SW of Khairpur	<u>Canis aureus</u>	1♀	"
C 284C	23 May 1963	Peshawar	3 mi. from Charsadda on Tangi Rd., 20 mi. NE of Peshawar	<u>Ovis aries</u>	4♂, 8♀	"
C 291C	26 May 1963	"	15 mi. W. of Saidu Sharif, Swat State	<u>Capra hircus</u>	1♂	"
C 292B	26 May 1963	"	Sirseena, 10 mi. W. of Saidu Sharif, Swat State	"	2♂, 2♀	"
C 293A	26 May 1963	"	"	<u>Ovis aries</u>	12♂, 11♀	"
C 308B	3 Jun 1963	"	5 mi. N. of Mansehra	"	5♂, 3♀	"

TABLE 32. Material examined and identified as Rhipicephalus haemaphysaloides haemaphysaloides Supino, 1897.

Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 309B	3 Jun 1963	Peshawar	8 mi. N. of Mansehra	<u>Capra hircus</u>	1♂, 1♀	V. C. McCarthy and Z. B. Mirza
C 310B	3 Jun 1963	"	"	<u>Ovis aries</u>	3♂, 2♀	"
C 312B	3 Jun 1963	"	"	<u>Bubalus bubalis</u>	4♂, 1♀	"
C 313B	3 Jun 1963	"	9 mi. NE of Naran in the Kagan Valley	<u>Capra hircus</u>	1♂	"
C 430	June, 1964	Azad Kashmir	Neelum Valley (Ath-Maqum and Kali Area) 5,500-7,000 ft.	"cattle"	4♂	Capt. Mahmood Ahmad, Dir., Animal Husbandry, Azad Kashmir
C 433C	June, 1964	"	"	"	1♂	"
C 864B	27 Jun 1964	Rawalpindi	Panjar, Rawalpindi Dist. (on Azad Pattan Rd.) 2,753 ft.	<u>Bos indicus</u>	1♂	Nazeer M. Khan and Z. B. Mirza
C 866B	28 Jun 1964	Azad Kashmir	Dhok, near Muzaffarabad	<u>Capra hircus</u>	1♂, 4♀	"
C 868B	29 Jun 1964	"	10 mi. S. of Muzaffarabad (on Srinagar Rd.)	<u>Bubalus bubalis</u>	4♂, 5♀	"



TABLE 32. Material examined and identified as Rhipicephalus haemaphysaloides haemaphysaloides Supino, 1897.

Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 876C	13 Jul 1964	Lahore	Bagrat, Sialkot Dist.	<u>Bos indicus</u>	2♂, 1♀	Z. B. Mirza
C 877B	13 Jun 1964	"	"	<u>Capra hircus</u>	13♂, 10♀	"
C 878	13 Jul 1964	"	"	<u>Equus caballus</u>	1♂	"
C 879	13 Jul 1964	"	"	<u>Ovis aries</u>	8♂, 7♀	"
C 1349B	14 Jul 1964	"	Tera, 8 mi. E. of Lahore	"	3♂, 1♀	Nazeer M. Khan
C 1350	14 Jul 1964	"	Jallo, 13 mi. E. of Lahore (Wagah Rd.)	"	8♂, 6♀	"
C 1394C	24 Aug 1964	"	"	<u>Capra hircus</u>	1♀	"
C 1397C	24 Aug 1964	"	Talwara, 18 mi. E. of Lahore	"	1♂, 2♀	"
C 1401C	24 Aug 1964	"	6 mi. N. of Lahore	"	1♂	"

TABLE 33. Material examined and identified as Rhipicephalus ramachandrai Dhanda, 1966.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 752	11 Jul 1964	Peshawar	Mansehra	<u>Tatera</u> sp.	2♂	Traub Group
B68642	- - - - -	Lahore	Changa Manga Forest	"	1♂	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan.

Collection No.		Date	Administrative Division	Locality	Host	Specimens	Collector
C	3B	31 Aug 1962	Lahore	Shahzada, 19 mi. S. of Lahore	<u>Bubalus bubalis</u>	5♀	V. C. McCarthy
C	11A	19 Sept 1962	"	Sheikhupura City	<u>Capra hircus</u>	1♂	"
C	14	21 Sept 1962	"	Model Town	<u>Canis familiaris</u>	1♂, 1♀	Z. B. Mirza
C	15A	22 Sept 1962	"	Shahpur	<u>Hemiechinus auritus</u>	17♂, 15♀	"
C	16	22 Sept 1962	"	Model Town	<u>Canis familiaris</u>	1♀	"
C	17	22 Sept 1962	"	Balloki	<u>Lepus nigricollis dayanus</u>	3♂	"
C	18A	26 Sept 1962	"	"	<u>Canis aureus</u>	22♂, 8♀	"
C	19	1 Oct 1962	"	Lahore	<u>Hemiechinus auritus</u>	3♂, 1♀	"
C	20	1 Oct 1962	"	"	"	10♂, 5♀	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 48A	31 Jan 1963	Khairpur	Goth Gohram Khan, 73 mi. SE of Khairpur	<u>Canis familiaris</u>	2♂, 7♀	V. C. McCarthy and Z. B. Mirza
C 54B	1 Feb 1963	"	Tajal	<u>Capra hircus</u>	1♂	"
C 57B	31 Jan 1963	"	"	<u>Lepus nigricollis ruficaudatus</u>	1♀	"
C 58A	31 Jan 1963	"	"	"	1♂	"
C 63	4 Feb 1963	Hyderabad	Nagar Parkar	<u>Canis familiaris</u>	1♀	"
C 68A	5 Feb 1963	"	Pithapur, on Salt Flats near Nagar Parkar	<u>Gazella gazella bennetti</u>	3♀, 2♂	"
C 69A	5 Feb 1963	"	Nagar Parkar	<u>Lepus nigricollis ruficaudatus</u>	1♂	"
C 74	16 Feb 1963	"	Manchar Lake (30 mi. from Dadu) Sind	<u>Canis familiaris</u>	3♂, 2♀	"
C 78B	17 Feb 1963	Khairpur	6 mi. NW of Jacobabad on Quetta Rd.	<u>Capra hircus</u>	11♂, 13♀	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 81	19 Feb 1963	Multan	Muzaffargarh (W. Bank of Chenab River)	<u>Ovis aries</u>	2♂, 4♀	V. C. McCarthy and Z. B. Mirza
C 82A	19 Feb 1963	"	"	<u>Capra hircus</u>	1♂, 3♀	"
C 91	6 Mar 1963	Lahore	Attari Saroba, 11 mi. S. of Lahore	<u>Canis familiaris</u>	1♂, 5♀	"
C 93	9 Mar 1963	"	Nabipur, 15 mi. WNW of Lahore on Sheikhpura Rd.	<u>Ovis aries</u>	7♂, 3♀	"
C 95	11 Mar 1963	"	Sharqpur, 20 mi. from Lahore on Sheikhpura Rd.	<u>Canis aureus</u>	6♂, 6♀	"
C 98	13 Mar 1963	"	Lalu Khichi (Balloki) 40 mi. from Lahore	<u>Ovis aries</u>	8♂, 14♀	"
C 102	14 Mar 1963	"	Rajkot, Area of Gujranwala	<u>Canis familiaris</u>	1♂, 1♀	"
C 113A	20 Mar 1963	D. I. Khan	8 mi. from Kalabagh Area on Jaba Rd.	<u>Lepus nigricollis</u>	6♂, 3♀	"
C 118A	23 Mar 1963	"	D. I. Khan City	<u>Capra hircus</u>	1♂, 3♀	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 121A	23 Mar 1963	D. I. Khan	Magim Shah, 14 mi. N. of D. I. Khan on Banu Rd.	<u>Capra hircus</u>	3♂, 3♀	V. C. McCarthy and Z. B. Mirza
C 124B	24 Mar 1963	"	4 mi. W. of D. I. Khan on Paharpur Canal	"	6♀	"
C 126A	24 Mar 1963	"	5 mi. W. of D. I. Khan on Paharpur Canal	"	19♂, 13♀	"
C 128	24 Mar 1963	"	Khana Sharif, 18 mi. S. of D. I. Khan on D. G. Khan Rd.	"	7♂, 2♀	"
C 129	24 Mar 1963	"	D. I. Khan City, near River Indus	<u>Canis aureus</u>	18♂, 13♀	"
C 130	24 Mar 1963	"	River Indus Bund near D. I. Khan Boat Bridge	<u>Lepus nigricollis</u>	2♂	"
C 131A	24 Mar 1963	"	"	"	10♂, 4♀	"
C 137F	27 Mar 1963	Quetta	Suleman Zai (30 mi. SW of Ft. Sandeman on Loralai Rd.)	<u>Ovis aries</u>	5♂, 4♀	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 138A	27 Mar 1963	Quetta	Suleman Zai (30 mi. SW of Ft. Sandeman on Loralai Rd.) 4,500 ft.	<u>Capra hircus</u>	2♂	V. C. McCarthy and Z. B. Mirza
C 159B	2 Apr 1963	"	Chagai, 36 mi. NNE of Dalbandin	"	1♂	"
C 162C	5 Apr 1963	Kalat	Irrai, 4 mi. S. of Panjgur on Turbat Rd.	<u>Ovis aries</u>	4♂, 5♀	"
C 164	5 Apr 1963	"	Borristan, 6 mi. S. of Panjgur on Turbat Rd.	<u>Capra hircus</u>	1♂	"
C 167D	5 Apr 1963	"	Vashbodth, 3 mi. NE of Panjgur on Kalat Rd.	"	3♂, 1♀	"
C 170	5 Apr 1963	"	4 mi. NE of Panjgur on Kalat Rd.	<u>Canis aureus</u>	1♂, 1♀	"
C 187B	20 Apr 1963	Khairpur	Khairpur Dist.	<u>Sus scrofa cristatus</u>	1♂, 1♀	Patton
C 197C	9 Apr 1963	Quetta	6 mi. E. of Ziarat on Loralai Rd.	<u>Ovis aries</u>	1♀	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 200C	10 Apr 1963	Quetta	Zangi Wal, 3 mi. E. of Loralai	<u>Ovis aries</u>	1♂, 1♀	V. C. McCarthy and Z. B. Mirza
C 204B	10 Apr 1963	"	40 mi. W. of Loralai on Ziarat Rd.	<u>Lepus capensis tibetanus</u>	2♂, 1♀	"
C 205D	11 Apr 1963	"	4 mi. from Loralai on Kila Saif Ulla Rd.	<u>Ovis aries</u>	2♂, 1♀	"
C 210B	13 Apr 1963	Multan	Taunsa Barrage	"	1♀	"
C 211	13 Apr 1963	"	"	<u>Capra hircus</u>	1♂, 4♀	"
C 212	13 Apr 1963	"	"	"	2♂, 3♀	"
C 217C	7 Apr 1963	Kalat	77 mi. SSW of Kalat on Panjgur Rd.	<u>Hemiechinus megalotis</u>	1♀	"
C 221B	23 Apr 1963	Lahore	Rajkot, 3 mi. from Gujranwala on Gondlawala Rd.	<u>Ovis aries</u>	1♀	"
C 225	23 Apr 1963	"	Balloki H. W., 40 mi. from Lahore	"	3♂, 3♀	Z. B. Mirza



TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 227	24 Apr 1963	Lahore	Rajkot, 3 mi. from Gujranwala on Bondla-wala Rd.	<u>Canis familiaris</u>	1♀	Z. B. Mirza
C 228B	24 Apr 1963	"	Gondlawala, 4 mi. from Gujranwala	<u>Capra hircus</u>	1♀	"
C 229	24 Apr 1963	"	"	<u>Canis familiaris</u>	8♂, 4♀	"
C 231C	2 May 1963	Bahawalpur	Lal Sohara, 22 mi. E. of Bahawalpur	<u>Ovis aries</u>	22♂, 7♀	V. C. McCarthy and Z. B. Mirza
C 232B	2 May 1963	"	9 mi. NE of Bahawalpur on Bahawal Nagar Rd.	<u>Capra hircus</u>	11♂, 14♀	"
C 234	2 May 1963	"	16 mi. NE of Bahawalpur on Bahawal Nagar Rd.	<u>Felis chaus</u>	1♂, 1♀	"
C 238E	3 May 1963	"	21 mi. SE of Bahawalpur	<u>Capra hircus</u>	43♂, 46♀	"
C 239B	2 May 1963	"	"	<u>Lepus nigricollis</u>	7♂, 8♀	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 240B	3 May 1963	Bahawalpur	18 mi. SSE of Bahawalpur on Yazman Rd.	<u>Capra hircus</u>	2♂, 5♀	V. C. McCarthy <sup>†</sup> and Z. B. Mirza <sup>†</sup>
C 242C	5 May 1963	"	4 mi. S. of Dera Nawab Sahib	"	3♂, 1♀	"
C 243B	5 May 1963	"	"	<u>Ovis aries</u>	2♀	"
C 244	5 May 1963	"	8 mi. S. of Dera Nawab Sahib	<u>Canis familiaris</u>	3♂, 2♀	"
C 248B	7 May 1963	Khairpur	Tajal, Khairpur Dist.	<u>Lepus nigricollis</u>	3♂, 1♀	"
C 250B	7 May 1963	"	Tajal, Khairpur Dist.	<u>Paraechinus hypomelas</u>	27♂, 8♀	"
C 251C	8 May 1963	"	Tajal, Khairpur Dist.	<u>Lepus nigricollis</u>	3♂	"
C 252	8 May 1963	"	Tajal, Khairpur Dist.	<u>Capra hircus</u>	2♂, 2♀	"
C 254	10 May 1963	Karachi	Sonmiani Beach Area, 32 mi. W. of Karachi	<u>Ovis aries</u>	5♂, 5♀	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 255C	10 May 1963	Karachi	Sonmiani Beach Area, 32 mi. W. of Karachi	<u>Capra hircus</u>	3♂, 1♀	V. C. McCarthy and Z. B. Mirza
C 260F	11 May 1963	"	24 mi. ENE of Karachi on Thano Bula Khan Rd.	"	5♂	"
C 261	11 May 1963	"	"	<u>Ovis aries</u>	1♀	"
C 262B	11 May 1963	"	"	"	1♂, 2♀	"
C 270C	14 May 1963	Khairpur	7 mi. from Gumbat Rest House on Rohri Canal (upstream), 8 mi. SW of Khairpur	<u>Capra hircus</u>	11♂, 10♀	"
C 271B	14 May 1963	"	"	<u>Ovis aries</u>	7♂, 7♀	"
C 272A	14 May 1963	"	11 mi. from Gumbat Rest House on Rohri Canal (upstream), 4 mi. W. of Khairpur	<u>Capra hircus</u>	8♂, 9♀	"
C 273C	14 May 1963	"	16 mi. SW of Khairpur on Karachi Rd.	"	7♂, 8♀	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806)  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 274A	14 May 1963	Khairpur	5 mi. from Gumbat Rest House on Rohri Canal (downstream), 20 mi. SW of Khairpur	<u>Canis aureus</u>	13♂, 6♀	V. C. McCarthy and Z. B. Mirza
C 275C	16 May 1963	Multan	7 mi. W. of Muzaffargarh on D. G. Khan Rd.	<u>Capra hircus</u>	1♂	"
C 276C	16 May 1963	"	"	<u>Ovis aries</u>	9♂, 12♀	"
C 279B	16 May 1963	"	8 mi. E. of Muzaffargarh (just short of Chenab Bridge)	"	4♂, 7♀	"
C 281	16 May 1963	"	"	<u>Capra hircus</u>	2♂, 1♀	"
C 283B	16 May 1963	"	20 mi. W. of Muzaffargarh	<u>Paraechinus hypomelas</u>	2♂, 18♀	"
C 287B	24 May 1963	Peshawar	3 mi. S. of Warsak, 12 mi. NW of Peshawar	<u>Ovis aries</u>	5♂, 10♀	"
C 291D	26 May 1963	"	15 mi. W. of Saidu Sharif, Swat State	<u>Capra hircus</u>	1♂	"
C 299B	29 May 1963	"	Kalam, Swat State	"	1♂, 1♀	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 305B	1 Jun 1963	Peshawar	Khyber Pass, Pak Side	<u>Ovis aries</u>	11♀	V. C. McCarthy and Z. B. Mirza
C 317	3 Jun 1963	"	10 mi. N. of Abbottabad	<u>Canis aureus</u>	1♂	"
C 324	10 Jun 1963	"	4 mi. W. of Gilgit	<u>Ovis aries</u>	1♂	Z. B. Mirza
C 326	13 Jun 1963	"	35 mi. S. of Gilgit on Chilas Rd.	<u>Capra hircus</u>	4♂, 6♀	"
C 326	13 Jun 1963	"	Chilas	"	7♂, 6♀	"
C 328C	13 Jun 1963	"	"	"	3♂, 9♀	"
C 329	13 Jun 1963	"	"	<u>Ovis aries</u>	8♂, 10♀	"
C 331	18 Jun 1963	"	Gole, 22 mi. NE of Skardu	<u>Capra hircus</u>	1♂, 3♀	"
C 332	18 Jun 1963	"	Gole	<u>Ovis aries</u>	1♂, 1♀	"
C 334	20 Jun 1963	"	Karis, 25 mi. E. of Skardu in Shyok Valley, 4,000 ft.	"	2♂, 2♀	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 335	21 Jun 1963	Peshawar	Ghuwari, 30 mi. E. of Skardu in Shyok Valley, 9,000 ft.	<u>Bos indicus</u>	2♀	Z. B. Mirza
C 336	21 Jun 1963	"	"	<u>Capra hircus</u>	4♀	"
C 337	22 Jun 1963	"	Parkuta, 32 mi. E. of Skardu, Indus Valley	"	1♀	"
C 338	22 Jun 1963	"	"	<u>Mustela altaica</u>	1♀	"
C 340B	18 Jul 1963	Multan	Taunsa Barrage, East Side	<u>Ovis aries</u>	2♂, 2♀	"
C 342	18 Jul 1963	"	Taunsa Barrage, W. Bank	<u>Canis familiaris</u>	3♂, 1♀	"
C 345B	18 Jul 1963	"	16 mi. N. of D. G. Khan	<u>Capra hircus</u>	11♂, 4♀	"
C 348	19 Jul 1963	"	6 mi. E. of Taunsa Barrage	<u>Canis aureus</u>	6♂, 14♀	"
C 351C	19 Jul 1963	"	10 mi. E. of Taunsa Barrage	<u>Paraechinus hypomelas blanfordi</u>	14♂, 13♀	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 352	19 Jul 1963	Multan	E. Bank of Indus at Taunsa Barrage	<u>Felis chaus</u>	3♂, 6♀	Z. B. Mirza
C 353	19 Jul 1963	"	E. Bank of Indus at Taunsa Barrage	<u>Canis aureus</u>	10♂, 12♀	"
C 354B	20 Jul 1963	Quetta	Kingri, 83 mi. E. of Loralai	<u>Ovis aries</u>	2♀	"
C 355C	20 Jul 1963	"	"	<u>Capra hircus</u>	3♂	"
C 358B	20 Jul 1963	"	"	<u>Lepus capensis tibetanus</u>	1♂	"
C 364	23 Jul 1963	"	20 mi. E. of Ziarat on Loralai Rd.	<u>Capra hircus</u>	2♀	"
C 365	23 Jul 1963	"	"	<u>Ovis aries</u>	1♂	"
C 366	24 Jul 1963	"	8 mi. W. of Ziarat, 6,000 ft.	<u>Capra hircus</u>	1♀	"
C 372	25 Jul 1963	"	10 mi. N. of Quetta, 7,000 ft.	<u>Ovis aries</u>	5♂	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 378B	26 Jul 1963	Quetta	Pishin, 20 mi. N. of Quetta	<u>Hemiechinus megalotis</u>	1♀	Z. B. Mirza
C 388	30 Jul 1963	"	Nushki	<u>Capra hircus</u>	3♂, 5♀	"
C 400	7 Aug 1963	Karachi	Korangi Creek, 15 mi. E. of Karachi	<u>Canis familiaris</u>	28♂, 20♀	"
C 403B	7 Aug 1963	"	Hawks Bay, Karachi	<u>Canis aureus</u>	2♂, 2♀	"
C 404	8 Aug 1963	"	"	<u>Canis familiaris</u>	58♂, 45♀	"
C 405C	8 Aug 1963	"	"	<u>Capra hircus</u>	1♂	"
C 406D	8 Aug 1963	"	"	<u>Ovis aries</u>	1♂	"
C 408C	10 Aug 1963	Khairpur	Nawabshah	<u>Capra hircus</u>	21♂, 31♀	"
C 409D	10 Aug 1963	"	"	<u>Ovis aries</u>	11♂, 9♀	"
C 412	10 Aug 1963	"	"	<u>Canis aureus</u>	2♂	"
C 413C	10 Aug 1963	"	"	<u>Lepus nigricollis dayanus</u>	9♂, 6♀	"



TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 414B	11 Aug 1963	Khairpur	Ubauro, 70 mi. NE of Sukkur	<u>Capra hircus</u>	42♂, 24♀	Z. B. Mirza
C 415C	11 Aug 1963	"	"	<u>Ovis aries</u>	3♂, 2♀	"
C 421C	13 Aug 1963	Bahawalpur	6 mi. S. of Bahawalpur	<u>Capra hircus</u>	9♂, 10♀	"
C 422B	13 Aug 1963	"	6 mi. S. of Bahawalpur, on Yazman Rd.	<u>Ovis aries</u>	3♂, 3♀	"
C 425	13 Aug 1963	"	Islam H. W., Bahawalpur	<u>Canis familiaris</u>	18♂, 12♀	"
C 442	13 Aug 1963	"	"	<u>Canis aureus</u>	76♂, 56♀	"
C 447C	14 Aug 1963	Multan	20 mi. NW of Islam H. W.	<u>Capra hircus</u>	5♂, 10♀	"
C 448D	14 Aug 1963	"	"	<u>Ovis aries</u>	7♂, 8♀	"
C 482B	24 Sept 1963	Peshawar	46 mi. W. of Rawalpindi (on Peshawar Rd.)	<u>Capra hircus</u>	1♀	V. C. McCarthy and Z. B. Mirza
C 484	24 Sept 1963	Rawalpindi	13 mi. W. of Rawalpindi, on Fatehjang Rd.	<u>Ovis aries</u>	2♀	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 493C	26 Sept 1963	Rawalpindi	18 mi. E. of Rawalpindi (on Azad Kashmir Rd.)	<u>Capra hircus</u>	5♀	V. C. McCarthy and Z. B. Mirza
C 496B	27 Sept 1963	"	Gujrat	<u>Ovis aries</u>	2♀	"
C 497	6 Oct 1963	Lahore	Sheikhupura	<u>Canis aureus</u>	1♂	"
C 510B	27 Oct 1963	Kalat	Kalat	<u>Ovis aries</u>	1♀	"
C 515	3 Nov 1963	Quetta	5 mi. W. of Sibi	<u>Capra hircus</u>	2♀	"
C 534	3 May 1964	Rawalpindi	Kohala, NE of Murree on Kashmir Rd. 2,000 ft.	"	3♂, 1♀	Traub Group
C 535B	3 May 1964	Azad Kashmir	8 mi. NE of Kohala on Muzaffarabad Rd., Azad Kashmir	<u>Bos indicus</u>	1♀	"
C 550A	24 Dec 1963	Lahore	Balloki, Dist. Lahore	<u>Lepus nigricollis</u>	1♂	"
C 565B	15 Jan 1964	"	Balloki, Lahore Dist.	"	2♀	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 605A	6 Dec 1963	Lahore	Model Town, 5 mi. SE of Lahore	<u>Hemiechinus auritus</u>	3♀	Traub Group
C 606A	17 Jun 1964	Quetta	Gulistan, Pishin Dist.	"Hedgehog"	3♂	"
C 629	10 Jun 1964	"	Lahore	<u>Canis familiaris</u>	16♂, 24♀	"
C 640	16 Jul 1964	"	"	<u>Lepus</u> species	1♀	"
C 673B	23 Jan 1964	Bahawalpur	Bahawalpur	<u>Ovis aries</u>	1♀	"
C 718	18 Aug 1964	Peshawar	Gilgit, Gilgit	<u>Homo sapiens</u>	1♀	"
C 786	11 Nov 1963	Hyderabad	Tatta	<u>Canis aureus</u>	1♂	V. C. McCarthy and Z. B. Mirza
C 787C	12 Nov 1963	"	"	<u>Lepus nigracollis</u>	1♂, 2♀	"
C 792B	13 Nov 1963	"	8 mi. W. of Tatta, on Karachi Rd.)	<u>Capra hircus</u>	2♂, 2♀	"
C 797	15 Nov 1963	Khairpur	20 mi. SW. of Kashmor, on Shikarpur Rd.	<u>Canis aureus</u>	1♂	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 803B	18 Nov 1963	Bahawalpur	Bhung, 15 mi. E. of Kashmor	<u>Ovis aries</u>	2♀	V. C. McCarthy and Z. B. Mirza
C 819B	3 Mar 1964	Lahore	Ghugian Lalu Khichi, Balloki H. W., Lahore	<u>Capra hircus</u>	1♀	"
C 820	3 Mar 1964	"	"	<u>Ovis aries</u>	5♂, 1♀	"
C 824B	19 Mar 1964	Multan	16 mi. E. of Taunsa Barrage, Rangpur Rd.	<u>Capra hircus</u>	2♀	"
C 825B	19 Mar 1964	"	"	<u>Ovis aries</u>	14♂, 5♀	"
C 827A	19 Mar 1964	"	Diara Din Panah, 8 mi. E. of Taunsa Barrage	<u>Lepus nigracollis</u>	11♂, 4♀	"
C 828B	21 Mar 1964	"	Taunsa Barrage (Rest House)	<u>Paraechinus hypomelas blanfordi</u>	7♂, 7♀	"
C 829B	24 Mar 1964	Quetta	15 mi. E. of Ft. Sandeman	<u>Ovis aries</u>	3♂, 1♀	"
C 830A	24 Mar 1964	"	"	<u>Lepus capensis tibetanus</u>	1♂	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 832B	25 Mar 1964	Quetta	35 mi. S. of Ft. Sandeman (on Loralai Rd.)	<u>Equus caballus</u>	1♂	V. C. McCarthy and Z. B. Mirza
C 841	31 Mar 1964	Kalat	Diz, 60 mi. SW of Panjgur	<u>Capra hircus</u>	2♂, 1♀	"
C 842A	1 Apr 1964	"	2 mi. E. of Panjgur (on Kalat Rd.)	"	6♂, 3♀	"
C 843	1 Apr 1964	"	"	<u>Ovis aries</u>	5♂, 3♀	"
C 848	6 Apr 1964	"	Surab, 43 mi. SSW of Kalat	"	2♂	"
C 853	9 Apr 1964	Quetta	10 mi. N. of Rakhni (on Kingri Rd.)	<u>Capra hircus</u>	1♀	"
C 854	9 Apr 1964	Multan	Fort Munro, D. G. Khan Dist.	<u>Ovis aries</u>	1♂, 2♀	"
C 860	7 Jun 1964	Lahore	Balloki H. W., Lahore Dist.	<u>Sus scrofa cristatus</u>	2♂, 1♀	Z. B. Mirza
C 881	25 Jul 1964	"	"	<u>Felis chaus</u>	2♂, 1♀	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 896B	6 Jun 1963	Lahore	Gujranwala Dist.	<u>Equus caballus</u>	7♂, 2♀	Dept. of Animal Husbandry (West Pakistan)
C 899	8 Jun 1963	Sargodha	Mianwali, Sargodha Dist.	<u>Canis familiaris</u>	15♂, 53♀	"
C 904E	1963	"	Shahpur, Mianwali Dist.	<u>Bubalus bubalis</u>	4♀	"
C 916	16 Aug 1963	Karachi	Karachi City	<u>Bos indicus</u>	15♂, 5♀	"
C 921B	1963	Sargodha	Shahpur City, Mianwali	"	8♂, 15♀	"
C 922	20 Apr 1963	Lahore	Gujranwala	<u>Canis familiaris</u>	2♂	"
C 939	17 Oct 1963	Karachi	Hab Chowki, (Hab River near Karachi on Bela Rd.)	<u>Ovis aries</u>	1♀	"
C 940	28 Aug 1963	"	"	<u>Camelus dromedarius</u>	1♂	"
C 949	6 Jun 1963	Lahore	Gujranwala	<u>Canis familiaris</u>	1♂, 33♀	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 955	20 Apr 1963	Lahore	Sialkot	<u>Canis familiaris</u>	4♂, 18♀	Dept. of Animal Husbandry (West Pakistan)
C 959C	April, 1963	"	Phooklian Bajwat Area, Sialkot Dist.	<u>Bubalus bubalis</u>	3♂, 9♀	Dept. of Animal Husbandry (West Pakistan)
C 970	22 Aug 1963	Hyderabad	Tando Ghulam Ali, Hyderabad Dist.	<u>Capra hircus</u>	2♂	"
C 981A	19 Aug 1963	Lahore	Harbanspura (Forest Area, 8 mi. E. of Lahore)	<u>Lepus nigricollis</u>	13♂, 9♀	Nazeer M. Khan
C 985	20 Aug 1963	"	8 mi. SE of Lahore (on Harike Rd.)	<u>Bos indicus</u>	2♀	"
C 986C	20 Aug 1963	"	8 mi. SE of Lahore (on Harike Rd.)	<u>Lepus nigricollis</u>	2♂, 3♀	"
C 988C	21 Aug 1963	"	Forest, 15 mi. SE of Lahore (on Harike Rd.)	<u>Vulpes bengalensis</u>	2♂	"
C 990C	21 Aug 1963	"	"	"	1♂, 3♀	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 991	22 Aug 1963	Lahore	Harbanspura Forest, 8 mi. E. of Lahore	<u>Lepus</u> <u>nigricollis</u>	10♂, 18♀	Nazeer M. Khan
C 992D	22 Aug 1963	"	"	<u>Vulpes</u> <u>bengalensis</u>	3♂, 1♀	"
C 993	22 Aug 1963	"	"	<u>Lepus</u> <u>nigricollis</u>	7♂, 6♀	"
C 994B	25 Aug 1963	"	"	<u>Canis aureus</u>	3♂, 2♀	"
C 995B	25 Aug 1963	"	"	"	3♂, 2♀	"
C 1002B	30 Aug 1963	"	Attari, 8 mi. SW of Balloki, Lahore	<u>Sus scrofa</u> <u>cristatus</u>	1♂, 1♀	"
C 1003	30 Aug 1963	"	"	<u>Canis</u> <u>familiaris</u>	2♂, 4♀	"
C 1006	6 Sept 1963	"	10 mi. above Main Bridge on Ravi, Lahore	<u>Lepus</u> <u>nigricollis</u>	4♂	"
C 1012	7 Sept 1963	"	9 mi. above Main Ravi Bridge, Lahore	<u>Capra hircus</u>	1♀	"



TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1013B	7 Sept 1963	Lahore	8 mi. above Main Ravi Bridge, Lahore	<u>Lepus nigricollis</u>	3♂, 5♀	Nazeer M. Khan
C 1014	7 Sept 1963	"	"	"	3♂, 3♀	"
C 1019C	9 Sept 1963	"	Lakhanke, 16 mi. E. of Lahore on Wagah Rd.	<u>Bubalus bubalis</u>	1♂.	"
C 1051	19 Sept 1963	"	Changa Manga Forest, 40 mi. SSW of Lahore	<u>Sus scrofa cristatus</u>	1♂, 8♀	"
C 1123B	20 Nov 1963	"	12 mi. N. of Lahore, Ravi River	<u>Lepus nigricollis</u>	1♂	"
C 1125B	22 Nov 1963	"	Changa Manga Forest, Lahore Dist.	"	3♂	"
C 1128B	23 Nov 1963	"	Chunian, 55 mi. S. of Lahore	"	1♂, 1♀	"
C 1131B	1 Dec 1963	"	15 mi. E. of Lahore (Wagah Rd.)	"	1♂	"
C 1146B	8 Dec 1963	"	Paddri Forest, 22 mi. SE of Lahore (Harike Rd.)	"	1♂	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1182A	2 Jan 1964	Lahore	Balloki H. W., Lahore Dist.	<u>Lepus</u> <u>nigricollis</u>	2♂, 1♀	Nazeer M. Khan
C 1185B	10 Jan 1964	"	23 mi. S. of Lahore (Ferozepur Rd., 6 mi. SW of Mile Marker 19)	"	4♂, 1♀	"
C 1186A	19 Jan 1964	"	12 mi. E. of Lahore (Wagah Rd.)	"	4♂	"
C 1190C	5 Feb 1964	Hyderabad	Kerla, 30 mi. E. of Umarkot, Thar Parkar Dist.	<u>Capra hircus</u>	2♂, 2♀	"
C 1195B	5 Feb 1964	"	13 mi. NE of Umarkot	<u>Camelus</u> <u>dromedarius</u>	5♂, 4♀	"
C 1213D	7 Feb 1964	"	Umarkot, Thar Par- kar Dist.	<u>Capra hircus</u>	2♂, 1♀	"
C 1214B	7 Feb 1964	"	"	<u>Ovis aries</u>	6♂	"
C 1222B	18 Feb 1964	Lahore	13 mi. E. of Lahore, Wagah Rd.	<u>Lepus</u> <u>nigricollis</u>	1♂	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1223B	20 Feb 1964	Lahore	17 mi. SE of Lahore (Harike Rd.)	<u>Lepus nigricollis</u>	3♂, 10♀	Nazeer M. Khan
C 1228C	27 Feb 1964	"	Malikpur, 13 mi. SE of Lahore (1 mi. S. of Harike Rd.)	<u>Capra hircus</u>	1♂, 1♀	"
C 1239	11 Mar 1964	Rawalpindi	Rawalpindi City	<u>Canis familiaris</u>	4♂, 3♀	"
C 1269	20 Mar 1964	"	Chakri, 29 mi. from Rawalpindi (Chakwal Rd.)	"	25♂, 25♀	"
C 1271B	24 Mar 1964	Peshawar	Mardan City	<u>Capra hircus</u>	3♂, 1♀	"
C 1279B	26 Mar 1964	"	Shah Mansur, 11 mi. from Swabi, Mardan Dist.	"	5♂, 6♀	"
C 1284B	26 Mar 1964	"	15 mi. NW of Mardan (Swat Rd.)	"	1♂, 1♀	"
C 1304A	28 Apr 1964	Lahore	Balloki H. W., Lahore Dist.	<u>Lepus nigricollis</u>	8♂, 6♀	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1305	28 Apr 1964	Lahore	Balloki H. W. Lahore Dist.	<u>Lepus nigricollis</u>	2♂, 3♀	Nazeer M. Khan
C 1309B	8 May 1964	"	13 mi. E. of Lahore	<u>Ovis aries</u>	1♀	"
C 1312	10 May 1964	"	13 mi. E. of Lahore (Wagah Rd.)	<u>Lepus nigricollis</u>	2♀	"
C 1313B	13 May 1964	"	Paddri, 21 mi. SE of Lahore (Harike Rd.)	<u>Capra hircus</u>	4♂	"
C 1320	25 May 1964	"	11 mi. NE of Lahore	<u>Canis aureus</u>	4♂, 3♀	"
C 1322C	25 May 1964	"	"	<u>Ovis aries</u>	1♀	"
C 1324B	25 May 1964	"	8 mi. N. of Lahore	<u>Lepus nigricollis</u>	1♂, 3♀	"
C 1339	1 Jun 1964	"	13 mi. E. of Lahore	<u>Canis aureus</u>	1♂, 2♀	"
C 1340	2 Jun 1964	"	Bahmanabad, 14 mi. E. of Lahore (Wagah Rd.)	"	1♂, 2♀	"
C 1391	23 Aug 1964	"	Rakh Paddri, 17 mi. E. of Lahore	"	1♂, 1♀	"

TABLE 34. Material examined and identified as Rhipicephalus sanguineus sanguineus (Latreille, 1806).  
Distribution: West Pakistan (continued).

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 1392	23 Aug 1964	Lahore	11 mi. E. of Lahore (Wagah Rd.)	<u>Canis aureus</u>	2♂	Nazeer M. Khan
C 1393A	24 Aug 1964	"	Jallo Area, 13 mi. E. of Lahore	<u>Ovis aries</u>	2♂	"
C 1394B	24 Aug 1964	"	Jallo Area, 13 mi. E. of Lahore	<u>Capra hircus</u>	7♂, 1♀	"
C 1397B	24 Aug 1964	"	Talwara, 18 mi. E. of Lahore	"	4♂, 2♀	"
C 1401B	24 Aug 1964	"	6 mi. N. of Lahore	"	3♂, 2♀	"
C 1415	15 Oct 1964	"	Changa Manga Forest, Lahore Dist.	<u>Canis aureus</u>	1♀	"
C 1417	20 Apr 1964	"	Lahore	<u>Canis familiaris</u>	1♀	W. McDonald
C 1421	March 1963	"	Lahore	Unknown	3♀	G. Coughran
C 1424	1963	Unknown	West Pakistan	"	8♂	R. D. Taber
C 1425	1963	"	"	"	3♂	R. D. Taber
M 553	18 Sept 1963	Peshawar	Mansehra, Hazara Dist.	<u>Vulpes vulpes griffithi</u>	1♂, 3♀	V. C. McCarthy and Z. B. Mirza

TABLE 35. Material examined and identified as Rhipicephalus sanguineus turanicus Pomerantsev and Matikashvili, 1940.  
Distribution: West Pakistan.

Collection No.	Date	Administrative Division	Locality	Host	Specimens	Collector
C 75	17 Feb 1963	Khairpur	Jacobabad	<u>Ovis aries</u>	13♂, 12♀	V. C. McCarthy and Z. B. Mirza
C 109B	20 Mar 1963	D. I. Khan	Kalabagh	"	2♂	"
C 112B	20 Mar 1963	"	2 mi. from Kalabagh on Indus River Bank	<u>Lepus nigricollis dayanus</u>	3♂	"
C 195	24 Mar 1963	"	D. I. Khan, Region of Indus River	<u>Paraechinus hypomelas blanfordi</u>	11♂, 9♀	"
C 310C	3 Jun 1963	Peshawar	8 mi. N. of Mansehra	<u>Ovis aries</u>	1♂, 1♀	"
C 323	10 Jun 1963	"	4 mi. W. of Gilgit	<u>Capra hircus</u>	2♂, 6♀	Z. B. Mirza
C 399D	4 Aug 1963	Karachi	Bela	<u>Ovis aries</u>	8♂, 14♀	"
C 982B	2 Jun 1964	Lahore	Harbanspura Forest 8 mi. E. of Lahore	<u>Vulpes bengalensis</u>	2♂	Nazeer M. Khan
C 1052	20 Sept 1963	Lahore	Balloki, 40 mi. SW of Lahore	<u>Lepus nigricollis</u>	3♂	"
C 1341	2 Jun 1964	Lahore	12 mi. E. of Lahore (Wagah Rd.)	"	1♂	"

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